

# Electrical Contracting

THE MAGAZINE OF ELECTRICAL CONSTRUCTION AND MAINTENANCE

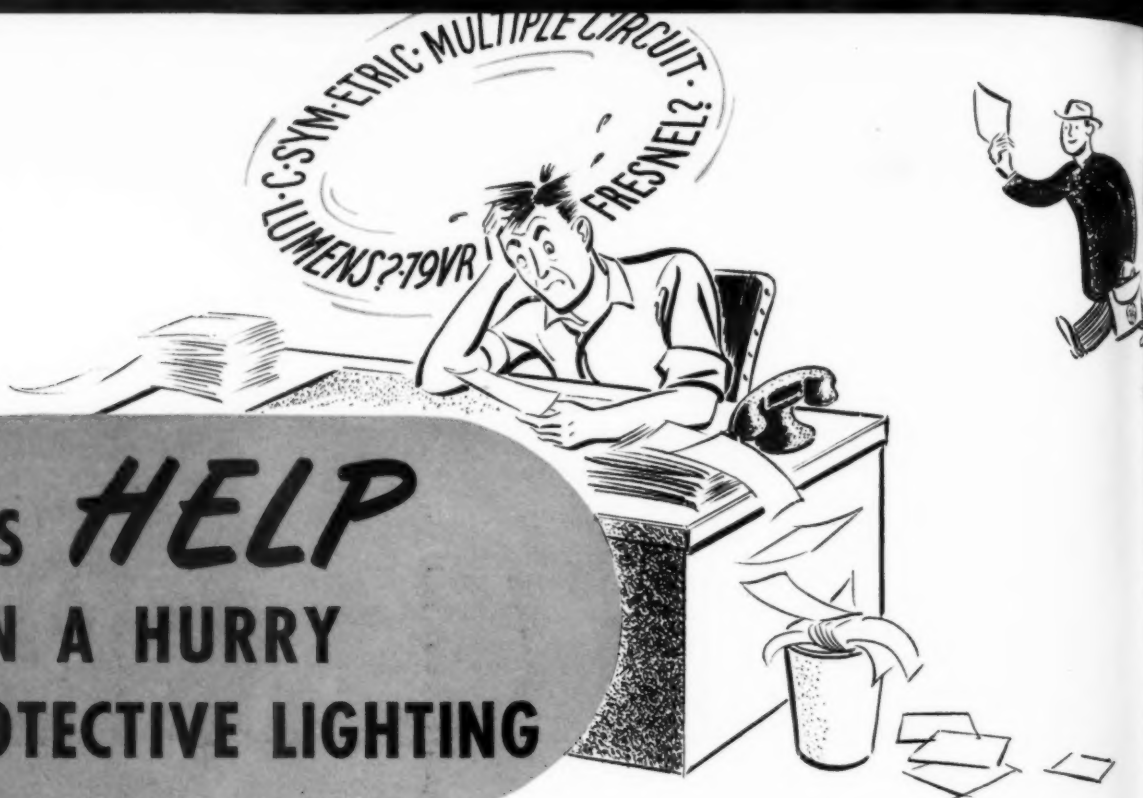
OCTOBER · 1942

Heavy cables are installed with portable rolling conveyor and clamped in hardwood block supports in feeder tunnels. See Wiring At Basic Magnesium, Page 17.

NECA convention report on pages 20 to 25.

● INDUSTRIAL ELECTRIFICATION SECTION  
PAGES 95 — 106.

# HERE'S *HELP* IN A HURRY ON PROTECTIVE LIGHTING



**W**HEN you're up against a new or difficult protective-lighting problem, it's important to get the right answer quickly. Getting it right the first time can save precious hours and days, and probably a lot of vital material that is needed for other war-producing industries.

Helping solve outdoor-lighting problems is no new job to us. Time after time our experience has made a difficult job easy. We have a complete line of floodlights and luminaires, including the new Form 79VR that's a natural for fence lighting. We offer you the services of

experienced on-the-job lighting specialists. And, we have made available to you a new 16-page bulletin crammed with helpful suggestions.

Instead of experimenting yourself with new types of equipment, see the G-E lighting specialist in your territory. He may have the answer to your problems. If he hasn't, he can still help you save time, because he can call on the G-E Illuminating Laboratory where the latest information is always available. Do it today. *General Electric, Schenectady, N. Y.*

**THIS PUBLICATION\* WILL HELP YOU DO A BETTER JOB OF PROTECTIVE LIGHTING—FASTER**



**PAGE 3** shows 14 typical applications of protective lighting. It's helpful in making sure that no vulnerable spot is left unlighted.

**PAGE 5** describes property-line lighting and tabulates the recommended mounting height, spacing, and lamp sizes for four different applications.

**PAGE 6** explains how to light areas around and between buildings with floodlights and luminaires. Also describes center tower lighting for large areas.

**PAGE 9** is a handy equipment selector. Tells exactly which type of unit to use for each of the 14 applications.

**PAGE 11** describes the Form 79VR luminaire. Explains how it provides the exact characteristics needed for property-line lighting.

**PAGE 14** discusses series and multiple circuits and gives the advantages of each.

\*GEA-3640A, "Lighting for Industrial Plant Protection." For your copy, write to General Electric, Section 451-65, Schenectady, N. Y.



The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in its plants manufacturing naval equipment.

# GENERAL ELECTRIC

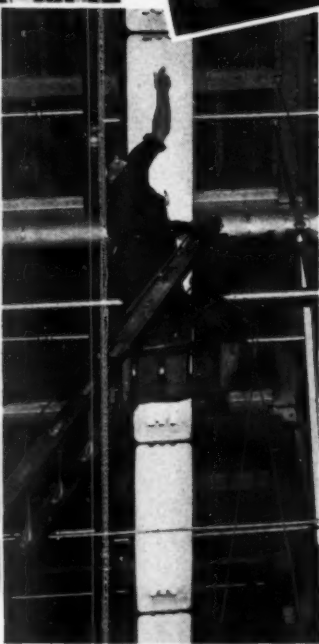
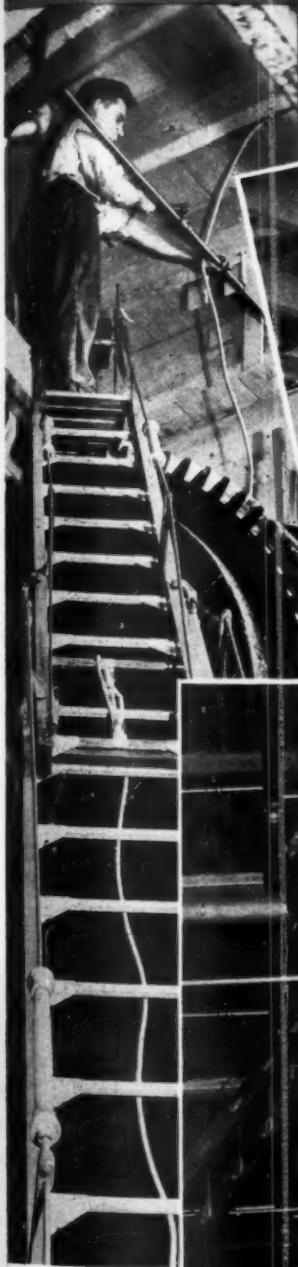
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# Easy overhead

**servicing** - without stops - in vital war work!

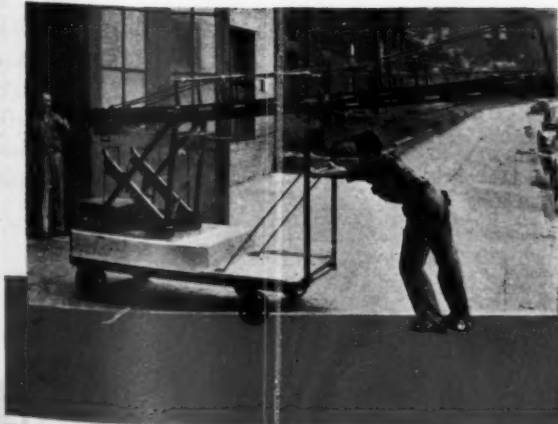
*It's safety!  
It's economy!*



**F**AST SERVICING of indoor, high-overhead fluorescents, sprinkler heads or "what-have-you"—without stopping production, even where aisles are narrow—is accomplished with ease by reaching over bench or machine. Murray Crows' nests mounted on caster trailers or electric platform trucks are the last word in adaptiveness. Send for the convincing facts that have made this aerial ladder favorite among utilities for more than a decade. No obligation. Metropolitan Device Corporation, Brooklyn, New York.

INDOOR—OUTDOOR

## Murray crows'nest



FOR MOUNTING ON  
CASTER TRAILERS  
ELECTRIC PLATFORM TRUCKS OR  
STANDARD COMMERCIAL TRUCKS (½ TON OR LARGER)

**ELECTRICAL CONTRACTING.** Published monthly, price 25 cents a copy, Vol. 41, No. 10. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Electrical Contracting, 330 West 42nd Street, New York, N. Y. Subscription Rates—U. S. A., and Latin-American Republics, \$2.00 a year, \$3.00 for two years, \$4.00 for three years. Canada \$2.50 a year, \$4.00 for two years, \$5.00 for three years. Great Britain and British Possessions 18 shillings for one year, 36 shillings for three years. All other countries \$3.00 a year; \$6.00 for three years. Entered as second-class matter August 29, 1936, at Post Office at Albany, N. Y., under the act of March 3, 1979. Printed in U. S. Copyright 1942 by McGraw-Hill Publishing Company. Cable address: "McGrawhill, New York." Member A. B. P. Member A. B. C.

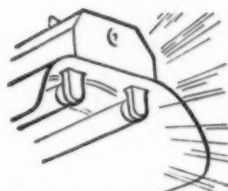


less steel • more light

WITH THE NEW

# Westinghouse Nonmetallic Reflectors

## HERE ARE THE FACTS!



Here's American ingenuity saving steel for Victory's weapons — providing fluorescent reflectors that give *more* light for war industry. They're the new Westinghouse nonmetallic reflectors—for 40-watt and 100-watt luminaires and for continuous-strip installations.

These open-type reflectors, with a 13-degree shielding angle, provide a reflection factor of 86% and an over-all efficiency of 81% with 2-lamp units and 78% with 3-lamp units. The nonflammable, moisture-resistant reflectors are one eighth-inch tempered Reflecto-board—a wood fiber material that will not lose its original, engineered contour.

These Westinghouse reflectors are finished by a specially selected synthetic baking enamel—white inside,

gray outside. The hard reflecting finish resists scratching and chipping. It is easily and safely cleaned with ordinary soap and water. The surface is repellent to acids, alkali, hydrogen sulfide and other industrial fumes. Because it will not oxidize, the finish retains its original whiteness, sheen and reflectivity.



Easy installation, maintenance and lighting system standardization offer advantages that are exclusive. The job of attaching and removing reflectors has been simplified to a simple "twist of the wrist." A mere quarter turn of two tension-locked thumb latches instantly attaches or detaches the take-down reflector. No tools are required. There is neither wasted time nor effort in installation and maintenance.

Complete interchangeability of these

nonmetallic reflectors and steel reflectors permits use of standard replacement parts and additional lighting units. There is no sacrifice in previously installed equipment nor lost production time while new lighting equipment is being installed.

These new fluorescent luminaires with nonmetallic reflectors are further examples of Westinghouse *engineered seeing*—a new technique of combining lighting equipment design and application



which is available through 117 Westinghouse Electric Supply Company Offices and Independent Lighting Distributors. Ask to-

day about the new nonmetallic reflectors or write to Westinghouse Electric & Manufacturing Company, Edgewater Park, Cleveland, Ohio.



# Westinghouse

LIGHTING  
EQUIPMENT





# War Against Wear



## DUST "BLANKET" NOW MORE DANGEROUS

The more dust that accumulates in the wound section to "blanket" a motor, the more danger of destructive temperatures. And today's round-the-clock operation gives a motor little chance to cool off!

In a production war like this one, everything that harms our motors helps the Axis. Dust, moisture, stray oil, friction — every motor enemy must be fought with skill and energy!

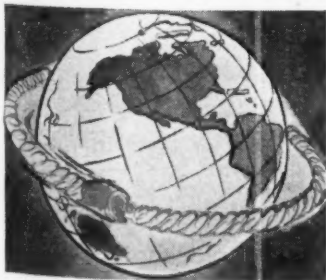
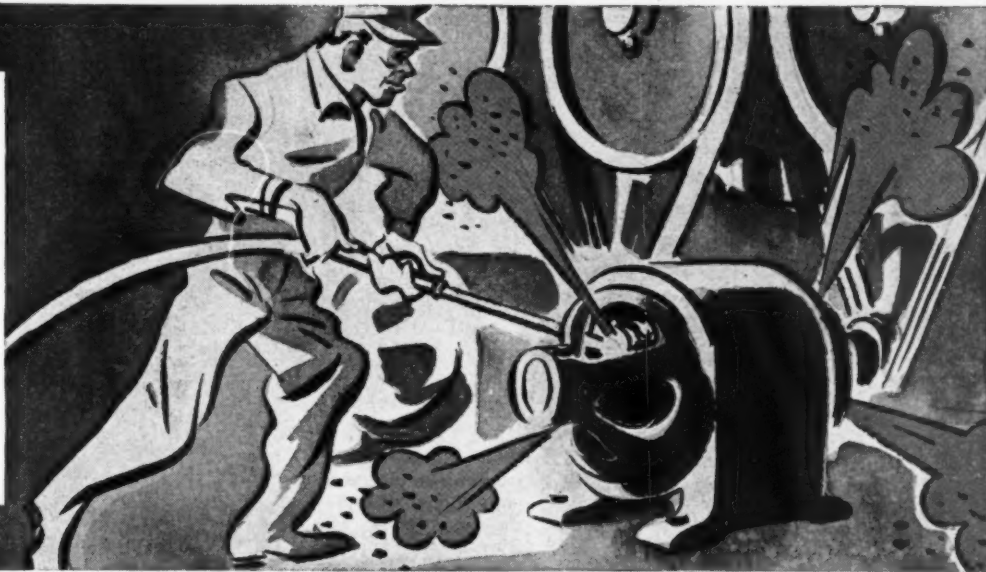
## IS PART OF THE WAR Against the Axis

### CLEAN MOTORS MAY LAST 5 TIMES LONGER

A clean motor will run cooler—last longer — build more guns — than a motor in which dust plugs ventilating passages and "blankets" windings.

But improper removal of dust can do as much harm as dust itself. And wartime is no time for trial-and-error maintenance!

That's why Allis-Chalmers has published — and offers free — "A Guide to Wartime Care of Electric Motors."

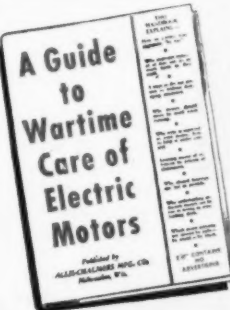


**AROUND WORLD IN 8 DAYS**  
— rotor travel in many motors working 24 hours a day for Victory!

### Send for this Valuable new Book. It's Free!

Everyone taking a fresh, new look at his maintenance operation will find "A Guide to Wartime Care of Electric Motors" immensely helpful.

It's completely illustrated, clear, highly interesting—applies to *all* makes of standard, general-purpose motors. Contains no advertising. Belongs in every engineer's and executive's technical library.



ALLIS-CHALMERS MFG. CO.  
Advertising Dept.  
Milwaukee, Wisconsin

Yes, I would like to receive *free* of charge your new motor care book.

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MILWAUKEE • WISCONSIN

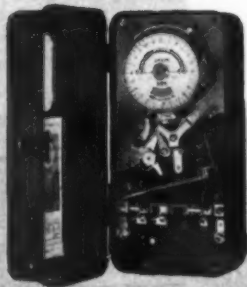


# KEEP.

PROTECTIVE LIGHTING  
ON THE JOB *with*  
AUTOMATIC CONTROL



Form KAZ astronomic dial time-switch will continue to automatically change its setting in accordance with sun-set and sun-rise.



Current interruptions up to 10 hours will not stop Form VSWZ astronomic dial time-switch, nor affect its "on" and "off" settings.

## SANGAMO TIME-SWITCHES

The protection of vital property with lighting is now more important than ever before. To keep protective lighting systems on the job—unfailingly and punctually—that is the function of a Sangamo Time-Switch. With this fully automatic control the factor of human error is eliminated and lighting is operated when, where, and as long as it is wanted. Choose from the complete Sangamo Line, which includes astronomic dial, synchronous carry-over, and outdoor time-switches.

**SANGAMO ELECTRIC COMPANY** **SPRINGFIELD ILLINOIS**



Here's the  
**TRANSFORMER**

*that* **STANDS UP BEST**

*under*

**Voltage Surges**

**Emergency Overloads**

**Dust and Dirt**

*Because it's a liquid-filled transformer...*

*AND it's free of fire hazard  
because the liquid is **PYRANOL***

333-kva Pyranol\*  
transformer, rated  
60 cycles, 2400/  
4160 Y volts to  
240/480 volts

**P**YRANOL transformers have all the features that have made liquid-cooled transformers the most nearly trouble-free electric apparatus in service today. For example:

They have high dielectric strength both at normal frequencies and impulse—an important safeguard against damage to the transformers from voltage surges caused by switching operations or by lightning. Immersion of the transformer interior in the Pyranol prevents drying and cracking of the winding insulation, a feature vital to maintenance of the high dielectric strength originally built into the transformer.

The heat-storage capacity inherent in liquid-filled transformers makes Pyranol units ideal for emergency overloads.

The pressure-tight tank protects vital parts of the transformers against damage from moisture, dust, dirt, and sabotage.

#### Additional Benefits

1. **Saving in Copper.** Secondary conductors (480 volts) require about 15 times as much copper as

equivalent lengths of 4160-volt primary conductors. In a typical, large industrial plant, installation of Pyranol transformers indoors at load centers can save 50 per cent or more on copper—30,000 pounds or more.

2. **Saving in Installation Cost.** Because Pyranol made possible a vaultless installation of several small transformers indoors (instead of one large transformer outdoors), it brought over-all savings of approximately 20 per cent in the installed cost of a plant distribution system.

3. **Saving in Power.** Pyranol transformers at load centers reduce copper losses as much as 25 per cent.

Ask your G-E representative for complete information, or write for Bulletin GEA-2048D. General Electric, Schenectady, N. Y.

\*Pyranol is the G-E trade name for askarel. Pyranol is nonflammable, and no Pyranol transformer has ever burned or contributed to a fire.



The Navy "E" for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.

**GENERAL  ELECTRIC**

405-32-0100

# ANACONDA'S PREVENTIVE

## TO SAFEGUARD CONTINUOUS PRODUCTION THROUGH PREVENTIVE MAINTENANCE OF ELECTRICAL SYSTEMS

**W**ITH raw materials so critical—copper and rubber especially—replacement of electrical wires and cables is naturally difficult. To help industry protect its electrical systems and at the same time conserve critical materials, Anaconda has developed the Anaconda Preventive Maintenance Plan, designed to *prevent* electrical system failures *before* they develop and thus safeguard production.

The Anaconda PM Plan provides a practical, automatic method for making a complete analysis of electrical circuits and equipment... uncovering potential weaknesses... showing methods for correcting them... and following with periodic check-ups.

In the average plant the plan should require less than an hour a week. It may save scores of production hours—it will cost you nothing.

One of its obvious values is that it encourages and assures the regular check-ups and thorough inspections so needed under today's conditions.

If a critical problem arises with no obvious solution, consult our engineering department or field service staff.

**NOTE:** The Preventive Maintenance Plan will aid your local W.P.B. Branch in making its decision on your request for material required to avert an actual breakdown.



*"Tomorrow may be*



# MAINTENANCE PLAN



## Anaconda PREVENTIVE MAINTENANCE Plan on request



Anaconda's PM Plan contains basic data useful to every maintenance engineer and electrical contractor. Includes charts for keeping a running check on the condition of your plant's electrical system. Will uncover danger spots, every chance for electrical breakdown, in your plant.

And for every potential weakness uncovered, a practical remedy is suggested.

The remedy, if applied in time, can be quite simple, whereas if actu-

al breakdown is permitted to occur, correcting it may be costly and even impossible.

For example, a loose lug, a corroded connection, exposure of cables to excessive heat, chemicals, oil, improper routing of cables . . . all such trouble points are automatically flagged by the Anaconda PM Plan as well as the major dangers.

Mail the coupon below—or bring it to the attention of the proper person in your plant.

42276

Anaconda Wire & Cable Company  
25 Broadway, New York City

Please send copy of the Anaconda PM Plan including posters, extra check charts, etc.

Individual.....


Company.....

Address..... City.....

*too late...do it today"*



**TO FURTHER  
CONSERVE  
STEEL...**

 **THE MILLER COMPANY** announces the new  
MILLER Engineered non-metallic fluorescent lighting re-  
flector...offering still further savings of critical material  
...and with the same man-made daylight performance.

You know, of course, that the MILLER Continuous Wireway Fluorescent System has always offered conspicuous savings of critical material (taking all items into consideration from power source right through to controls). Now, we are pleased and proud to tell you that the new MILLER-Engineered *non-metallic* reflector will increase those savings substantially... thus contributing still further to the war effort.

Significantly, too, so far as the lighting of your customers' plants is concerned, this further metal saving means absolutely no sacrifice in any way of the high standards of MILLER lighting.

MILLER 50 FOOT CANDLER or 100 FOOT CANDLER will provide fine, man-made daylight... adequate productive illumination evenly distributed over every working surface.

Employees will see better, feel better, work better with this kind of wartime lighting.

There are other noteworthy MILLER benefits, too... savings in power consumption, in installation time and dollars... that, in turn, benefit you. *Why*

*don't you write for all the facts...* and let us have a MILLER engineer work with you in planning the most efficient lighting layout to meet your customers' individual war production problems. There are many ways he can be useful to you today. (Representatives in principal cities.)

**BUY U. S. WAR BONDS**



**50 FOOT CANDLER  
100 FOOT CANDLER  
MILLER TROFFERS**  
*Continuous Wireway Fluorescent  
Lighting Systems*



**THE MILLER COMPANY**  
MERIDEN, CONN.  
*Pioneers in Good Lighting Since 1844*  
• MILLER offers a complete line of  
filament and fluorescent lighting equipment.



# 4

# SIMPLE STEPS

## *To Save*

★ Months of Time *and*  
★ Tons of Vital Materials

—in Getting Electric Power to New Production Machinery



1. Decide on a modern load-center distribution system using load-center unit substations.



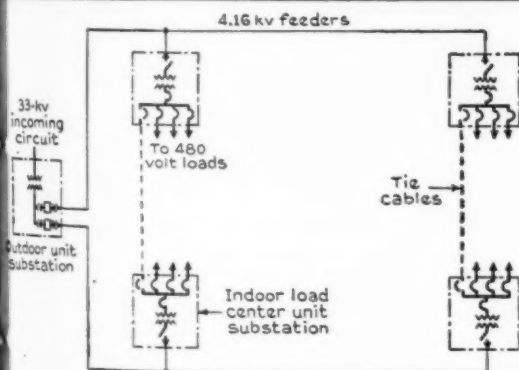
3. Specify standard equipment; standardization means you get better equipment more quickly and at lower cost.



2. Make a simple, one-line electrical layout of your proposed plant.



4. Order your electric equipment as soon as possible so that it will be available for immediate installation when construction has progressed far enough.



A typical one-line diagram of a load-center distribution system, with power being distributed at high voltage (2.4 to 13.2 kv) to unit substations located near the centers of electrical load areas—eliminating long, heavy, low-voltage feeders from a distant large substation. Thus, you save tons of copper, and the performance of motors, lamps, etc., is improved because of the reduction in voltage drop.

BY following these steps in General Electric's plan to provide standard load-center distribution equipment in the shortest time possible, you can save from *one to six months* of the time ordinarily required. You eliminate hours and hours at the drawing board, and long, drawn-out correspondence.

What's more, load-center distribution saves tons of steel, copper, and other vital materials; installation time is quicker, and service better.

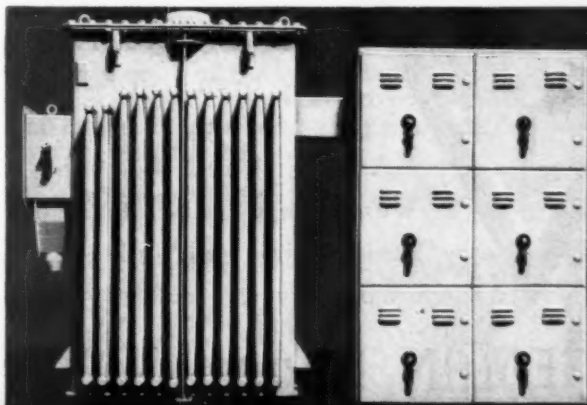
To help you get your equipment specified, purchased, and installed under this new, short-time plan, a new "handy guide" is just coming off the press. Mail the coupon for your copy today.



General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

**General Electric,  
Schenectady, N. Y.**

Factory-assembled, safety-metal-enclosed unit substations are quickly and easily installed right at load centers—without expensive vault construction, thanks to Pyralol. Simply slide the completely assembled sections into position and connect to the primary and secondary cables.



**General Electric Co., Sec. E 302-10  
Schenectady, N. Y.**

I understand your new handy guide to "Quickly Installed Electric Power Systems" (GED-1006) explains in detail the steps to follow in order to get power to new production machinery in one to six months less time. Please send me a copy.

Name.....

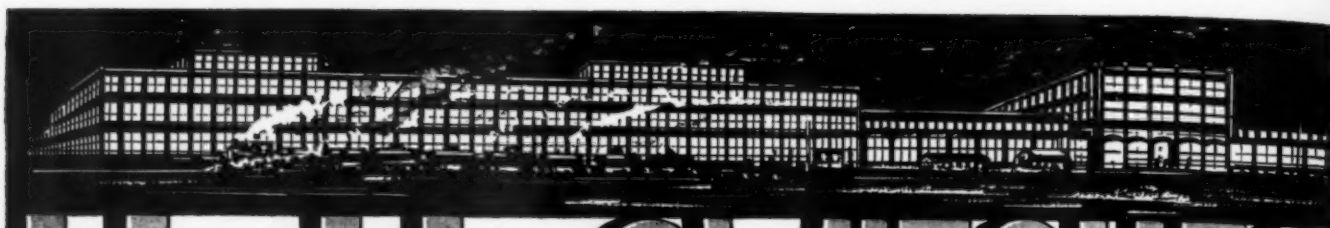
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**GENERAL ELECTRIC**



# H & H - SWITCHES

## UPHOLD PLANT MAINTENANCE



**DIVERSITY** of types meets "current" needs for new construction, conversion or replacements. Heavy-duty controls for lighting or power circuits:—specification-grade T-rated 10, 20 and 30 Ampere "Type C" Switches, Rotary Snap Switches, Ceiling Pull Switches, Door Switches, Flush Tumbler Switches with or without outlet box covers.

**DEPENDABILITY** of mechanisms meets war demands for uninterrupted service on critical jobs. For more than a half-century, H & H Switches have been *tested-by-use* for emergency conditions now general. Among the first in the field, they were long since promoted to the "ranking line" for under-fire assignments the world over.

**HART & HEGEMAN DIVISION**  
THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

# **SPEED UP** Installation of Control **3 Ways with** ***G-E COMBINATION STARTERS***



## **MOUNTED 50% FASTER**

Combinations make it possible for you to eliminate one complete mounting job on every control installation. That's because the motor-circuit switch and magnetic switch are combined in one control unit and can be mounted in one operation.

## **WIRED 40% FASTER**

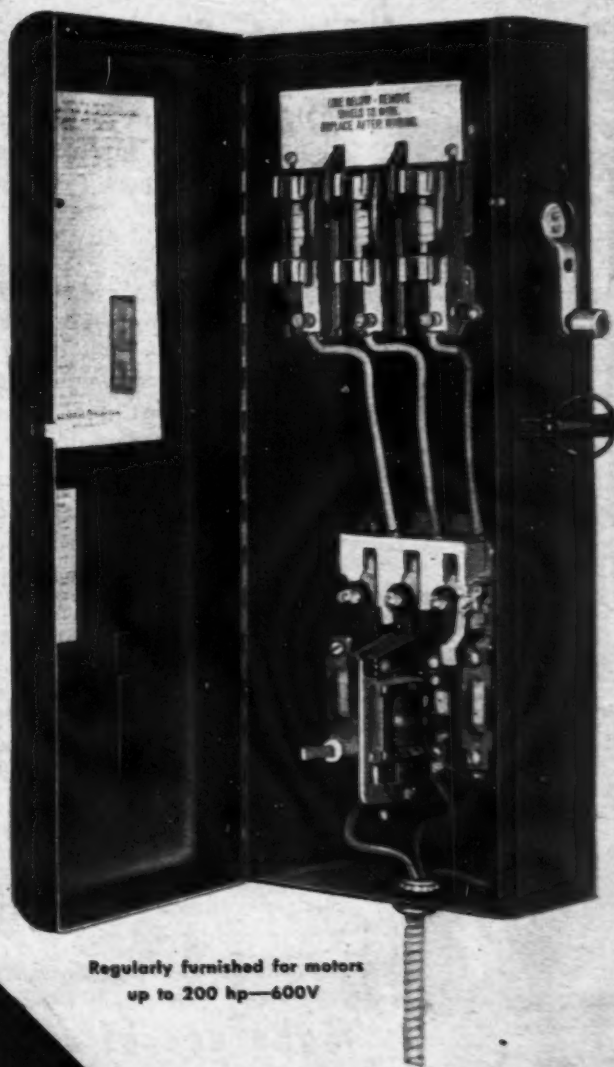
A survey of G-E combination starter users shows that they are saving up to 40 per cent of the time they formerly spent on wiring control installations where a separately mounted motor-circuit switch and magnetic starter were used. That's because G-E combination starters come to you completely wired—all you have to do is hook up the power and motor leads and you're ready to go.

## **SIMPLER TO ORDER**


Combination starters make it possible for you to order the correct starter for your motor in only the time it takes to dictate a letter—or to telephone. That's because a G-E combination starter includes *both* a fused manual circuit switch and a magnetic starter complete with overload relays. Just tell us the rating of your motor and the type of load it drives, and we'll send you everything you need to control and protect that motor in one compact control unit.

*General Electric, Schenectady, N. Y.*

### **Formula for Faster Installation of Control**

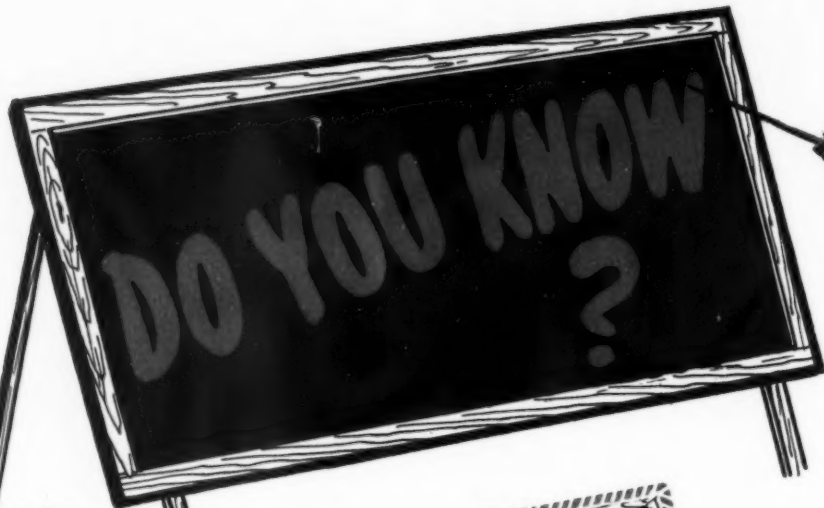


Regularly furnished for motors  
up to 200 hp—600V

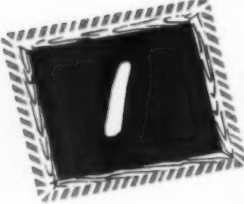
  
General Electric and its employees  
are proud of the Navy award of  
Excellence made to its Erie Works for  
the manufacture of naval ordnance.

**GENERAL  ELECTRIC**





**THAT:**



A new type of wire may be more desirable for a given location than the one most frequently specified?



BULLETIN OK-1011 is invaluable in deciding what kind of wire and cable to use for specific jobs? That it contains, in addition to a Selector Chart: Recommended types of insulation—Conductor strandings and designs—Protective coverings for various conditions—How to approach the problem of getting cable today—Purchase specifications—Data to include in your inquiries to speed handling? That we will send a copy free on request?



New developments are being made constantly in Hazard wire and cable insulations?



Such developments are important in connection with W. P. B. restrictions on electrical wiring?



Hazacode, Type R wire is durable and flame-resisting and fully meets the requirements of the National Board of Fire Underwriters and the National Electrical Code?



Hazard engineering service will help you with any electrical problems in planning new projects or remodelling old ones?



With new research developments and ever-changing war regulations concerning the use of copper and rubber, you can use Hazard engineering service profitably?



There are Hazard district offices in all principal cities of this country where Hazard engineers may be consulted, without obligation, as to the best type of wire to specify?

**Make use of this HAZARD ENGINEERING SERVICE!**



**HAZARD INSULATED WIRE WORKS**  
DIVISION OF THE OKONITE COMPANY  
Works: Wilkes-Barre, Pennsylvania  
Offices in Principal Cities



**HAZARD**

**Insulated Wires & Cables**

"BUY U. S. WAR BONDS... Every Payday All Hazard Employees BUY U. S. WAR BONDS"

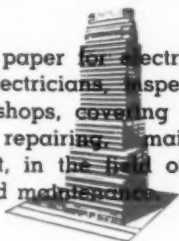
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A practical paper for electrical contractors,  
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and motor shops, covering engineering, in-  
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A **DOUBLE** SERVICE  
TO UNCLE SAM!

**Guth**  
**MAZE-LITE**  
Trade Mark Registered U. S. Patent Office  
**NON-METALLIC REFLECTORS**



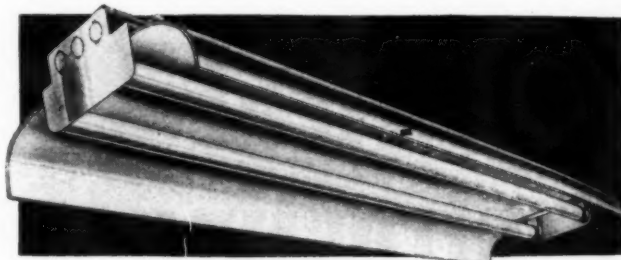
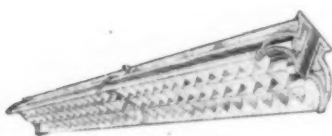
**DELIVER MORE LIGHT FOR WAR PRODUCTION—  
SAVE METAL FOR WAR INDUSTRIES!**

THE new GUTH Maze-Lite is designed for 2-40, 3-40, or 2-100 Watt Fluorescent Lamps. Its Reflector is formed of sturdy Pressed-Wood instead of steel. It readily accepts our durable "300° White" flexible-base finish which, with the large "reflector-mouth" design, produces greater light output than does Porcelain Enameled steel reflectors. More light means better seeing to speed urgent wartime production. And the saving of metal releases hundreds of tons for tanks, ships, guns, and planes.

**GUTH Fluorescent for Every  
Industrial Seeing Need!**

**FUTURLITER**—For 25 to 100 Foot Candles, Eggcrate Shielded, Semi-Direct Type Lighting. Continuous and Unit Mounting.

**HIGH BAYS AND LOW BAYS** for Filament and Mercury Lamps. Porcelain Enameled Reflector Units. Lamp shielding. Heavy duty sockets.



**FEATURES OF GUTH MAZE-LITES**

1. Durable "300° White" synthetic Baked-Enamel Pressed-Wood Reflector provides comfortable lamp shielding.
2. Reflector edges are sanded clean, then saturated with separate brushed-on enamel coating to guard against moisture.
3. "Side-of-Channel" Starters for easy trouble-shooting. All starters in one group at one end of channel.
4. "Bump-Proof Socket Plates" protect lampholders from abuse and insure their upright positioning in service.
5. Knockouts on 28" centers for direct-attachment of No. 8 Jack-Chain to channel — no extra parts needed.
6. Knockouts on 25" and 38" centers for attachment of 1/2" Conduit with locknuts.
7. Three knockouts in each End for locking channels together for End-to-End Mounting.

**FORTIETH YEAR OF**

**Guth**

**LIGHTING LEADERSHIP**

**THE EDWIN F. GUTH CO. • 2615 Washington Ave. • St. Louis, Mo.**



# Electrical Contracting

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## WAR MAKES THE RULES

The cumulative weight of NECA opinion and comment at Bigwin last month hammered home one all-important message. The most urgent, the most vital problem facing the electrical industry today is War. Every issue and discussion had to adapt this universal factor which has a way of confounding all the old formulae and of challenging conventional thinking.

We used to think of the minor alterations of our Code structure as weighty and complicated. Today the very fundamentals of safety rules are being attacked. What is the irreducible minimum? Our standards are rapidly approaching the minimum consistent with a maximum war effort. They could go lower. That means added responsibility, greater skill, more certain competence in the execution of our work. It is an immediate challenge to all of us.

Apprenticeship was once one of those perennials that could always be leisurely shoved aside for another year. The need for skilled men is becoming desperate today. Training on the job is the only way to get them in the number we need for war work. Here again each of us has a personal responsibility. Apprentice training must be carried on in every community and in every shop in the country. This is another challenge that must be answered quickly and effectively.

While we help create the greatest military arsenal of all time, we must compete with other industries and our own armed services for metals and men. Our only justification for such competition is the urgent military need for the work our industry is doing in the war. National resources are seriously limited and cautiously earmarked to spread them out to the greatest benefit in the war effort. Much of this distribution must be a matter of plain human judgment.

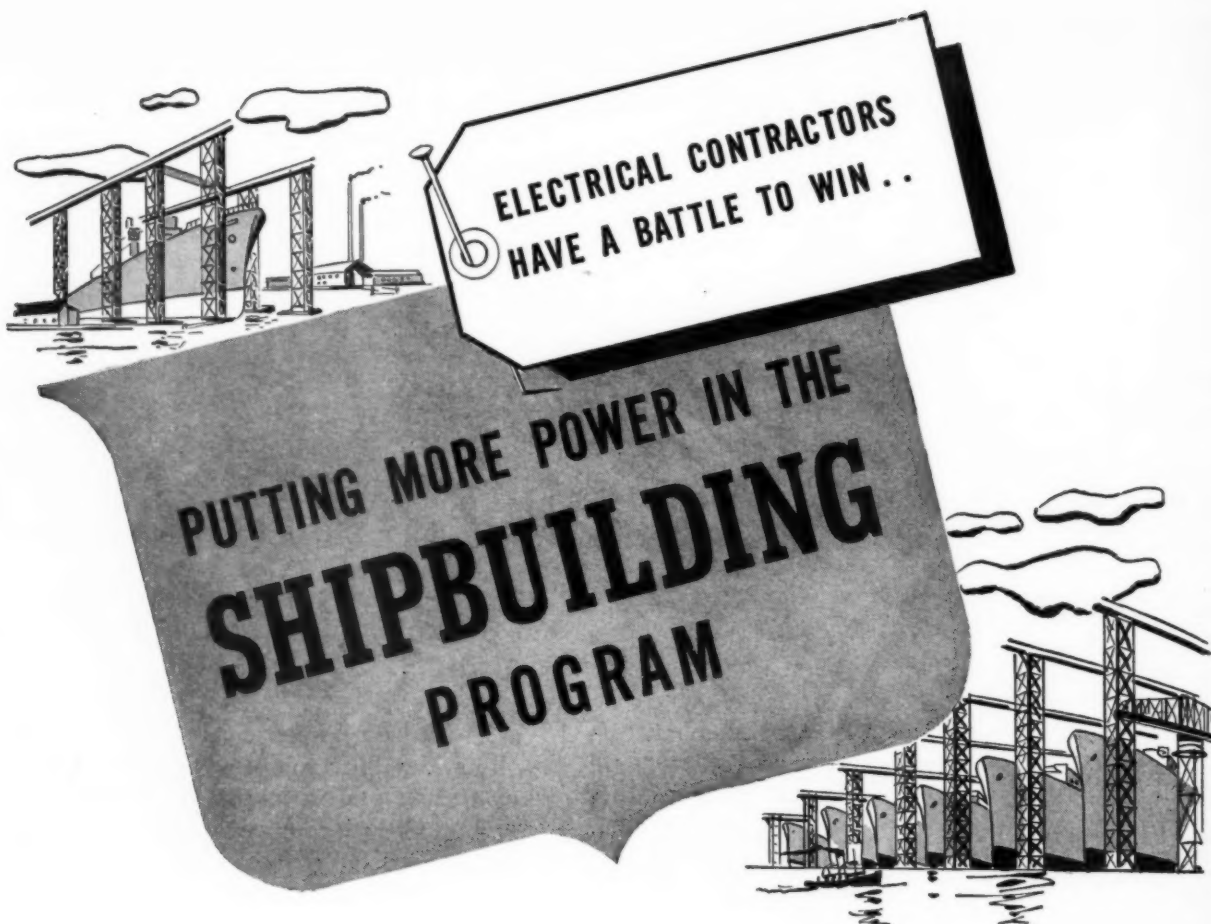
The competitive position of our industry in regard to metals and men is not nearly as strong as it ought to be. Reliable, safe, adequate industrial wiring is the very backbone of modern war. The facts must be better understood in Washington. This too, is a challenge.

And, looking ahead, we hear talk of a poverty-free world. With all the immediate demands on our thinking, post-war problems seem somewhat nebulous. However, the time will come when we can again take stock and plan ahead. The electrical construction and installation industry must have a full share in contributing to that new world. Shall we then have the will, the vision, and the industry ingenuity to create and consolidate our own opportunities?

That is, perhaps, the greatest challenge of all.

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OCTOBER, 1942



**I**N a modern shipyard, it's *electricity* that does most of the work: electric tools and shop equipment, electrically powered cranes and derricks, electric arc welding machines, electric floodlighting for 24-hour-a-day operation.

To get all our new shipyards going on time means busy days . . . and nights . . . for the electrical contractor who is ready to tackle an arduous job. Adequate power must be brought from substations and switchboards to each motor and machine. Many of the power and lighting circuits require protected outdoor construction, with runs of flexible cable to portable tools. In addition, a wiring network for alarm and communication is required.

Like any of the war jobs you're likely to be tackling today . . . industrial conversion . . . army camps . . . air bases . . . defense housing . . . it calls for the *best local aid you can get* on equipment and supplies. And that's where you have a strong ally in GRAYBAR.

More than 200 manufacturers of the equipment frequently specified for these and other war jobs depend on GRAYBAR to speed their products to the point of need. Thanks to nationwide experience on such jobs, GRAYBAR has a good grasp of the problems of heavy construction. Thanks to a knowledge of your own needs and methods, your local GRAYBAR man can help you fulfill the contract on time and at a profit.

**These Graybar-distributed products are widely used on Shipyard Jobs**

*Crouse-Hinds* searchlights, floodlights and other special types of outdoor lighting. Also *Benjamin* outdoor lighting equipment and *General Electric* street lighting units. *General Electric* Mazda lamps.

*Bulldog* BUStribution Duct and other modern wiring specialties and supplies. *Harvey Hubbell* industrial wiring devices. *Simplex* *Tirex* flexible cable. *General Electric* Motors and motor control, conduit, wiring devices, panel boards, circuit breakers, fuses and miscellaneous supplies.

*Graybar* Inter-phones, *Webster* Teletalk, *Edwards* Lokator and other signaling and alarm equipment.

# GraybaR

**IN OVER 80 PRINCIPAL CITIES**

**Executive Offices: GRAYBAR BUILDING, NEW YORK, N. Y.**



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# The Chemical Engineer cuts years to months...

*Born in the turmoil of the last war, he is shaping a new world with mighty swords and magic plowshares*

---

GERMAN CONSUL-GENERAL HOSSENFELDER, writing from New York on March 3rd, 1916, to von Bethmann-Hollweg, chancellor of the Imperial German Government, confidently predicted defeat for the United States because we were totally dependent upon the great chemical industry of Germany. "Americans," he wrote, "can never establish such an industry. They have the resources but they lack the necessary science and technology. And, besides, the conflicting selfishness of American business renders it impossible."

Even before the ink was dry on Hossenfelder's letter a new figure appeared on the industrial scene—the American chemical engineer. With the help of patient, but progressive and venturesome capital, he laid the foundations for the largest and most resourceful chemical industry in the world.

Today he is an all-important figure. For we are fighting a chemical war, even though the emphasis that is placed on planes, tanks, ships, guns and other armament tends to obscure that fact. And this chemical engineer is waging war for us on a prodigious scale. Bombers carry more tons of more deadly explosives because he has developed stronger and lighter alloys and more efficient fuels. Tanks are better armored and wield heavier blows because of products and processes born in chemical laboratories. Ships are welded together by new metallurgical techniques that save precious months over older processes. Gun barrels that are made in minutes instead of hours shoot farther and faster because of better ammunition.

And quantity keeps pace with quality. By mid-year of 1942, explosives were being produced in newly constructed plants twelve times faster than a year ago. Smokeless powder output has been doubled since December. Five times as much TNT was being made in July as in the months preceding Pearl Harbor. One single new plant produces more of this high explosive than did the entire pre-war industry—and several of these plants already are in production.

By what Major General William N. Porter, Chief of the Chemical Warfare Service, calls a "miracle of production," the sort of incendiary bombs that General Doolittle's lads showered on Tokyo were rolling out of

our plants within a few weeks after we got into the war. As General Porter puts it, "they were rolling not by hundreds or even thousands, but by the millions." That record he has cited as a tribute to the "ingenuity, industriousness and patriotism" of the American chemical industries.

Yet the General agrees that we have only started to produce in the tremendous volumes that will shortly make Germany, Italy and Japan "revolve on their boasted Axis." Our newest plants are just coming into production. They face no limiting shortages of materials for, in the main, our chemical industry draws its strength from coal, salt, sulphur, limestone, oil, natural gas, coal-tar, air and water—all available in abundance.

We have heard little about the use of poison gas by our enemies. It may be that good reasons for this are stored away in our well-stocked chemical arsenals. American chemical manufacturers have worked hard and long with our armed forces so that if the time ever comes to make good on the President's warning of retaliation, America will be more than ready.

And defense against gas has not been overlooked. Every soldier is equipped with a most efficient type of gas mask, developed through twenty-five years of intensive research. The Chemical Warfare Service already is manufacturing millions of masks for distribution to civilians. Let us hope we may never have to use them. But if we must, we need have little fear of any gas or secret chemical.

This gas mask program has been made possible by a literal metamorphosis of production facilities, as peacetime industries have been converted to war purposes. A lumber company, for example, is making activated carbon from sawdust. Novelty manufacturers of rubber goods are turning out valves and assembling other parts. Former manufacturers of shirts, swim-suits, shoes and beds have converted their facilities and are contributing their share. More than eleven hundred contractors and two hundred and fifty sub-contractors are supplying their full quotas of chemical warfare materials. And production is right up to schedule.

But the bulk of the war job of our chemical industries has to do with items other than weapons and



ammunition. The German Consul-General, in that 1916 report to Berlin, said that many American industries were in a critical condition because of the scarcity of German chemicals. He related in particular that "the cries for help from the world of physicians are becoming louder and louder and more and more insistent." Thanks to our chemical industries this cry no longer is heard. Even though we are again cut off from quinine, camphor and some other strategic medicinals, our homes and hospitals are adequately supplied with synthetic products. Most of these are better and cheaper than the natural materials. The same sulfa drugs that have saved so many civilian lives in recent years have gone to war, with the result that deaths from infection at Pearl Harbor and Bataan are reported as surprisingly low. In this war we suffer no shortages of iodine and potash. Pioneering research in the field of vitamins has led to new industries that are contributing to health and better nutrition.

Those new uniforms the soldiers are wearing are of better quality and will last longer than the shoddy, ill-fitting outfits of 1918—thanks to sunfast dyes and new man-made products. And in the field of fabrics, nylon and the new rayons have gone to war in parachutes and super-strong cords for tank treads and tires.

\* \* \* \* \*

And that brings up the question that 30,000,000 American motorists are asking with ever increasing concern. "When, Mr. Chemical Engineer, are you going to give us a set of new tires for the old family bus?"

That, I am told, is just what the chemical engineers have set about to do on a scale that is difficult to comprehend. In the words of Raymond Clapper, the columnist, "the synthetic rubber program for this year and the next is the biggest job of chemical engineering ever undertaken in the world." A billion dollar industry is being built at record speed to make almost a million tons a year of chemical rubber to serve our war needs and those of our allies. This cannot be accomplished overnight. Many months are required to design and fabricate complex equipment, much of which must be made from corrosion-resisting metals and alloys. We shall be lucky if a tenth of the desired capacity is in continuous production this year and even more lucky if, by the end of next year, the new industry should be turning out synthetic rubber at a rate of 875,000 tons—using both petroleum and grain as raw materials.

All this, of course, must go for essential military uses but there is reason to believe that in the laboratory and pilot-plant stages we have some promising substitutes and stop-gap materials that may tide us over until the big program starts rolling.

The present prospect of real success is possible only because of the cooperation of the chemical, rubber and petroleum industries. Individual firms and entire industries have set aside their normal desires and selfish interests to pool their patents, share their research and engineering developments for the common good. Synthetic rubber is here to stay as the basis for a great post-war industry: no doubt as to that lingers in the minds of the men who have seen many other natural products—indigo, alizarine, camphor, vanillin—all eventually fall before the ingenuity of the chemical industry.

\* \* \* \* \*

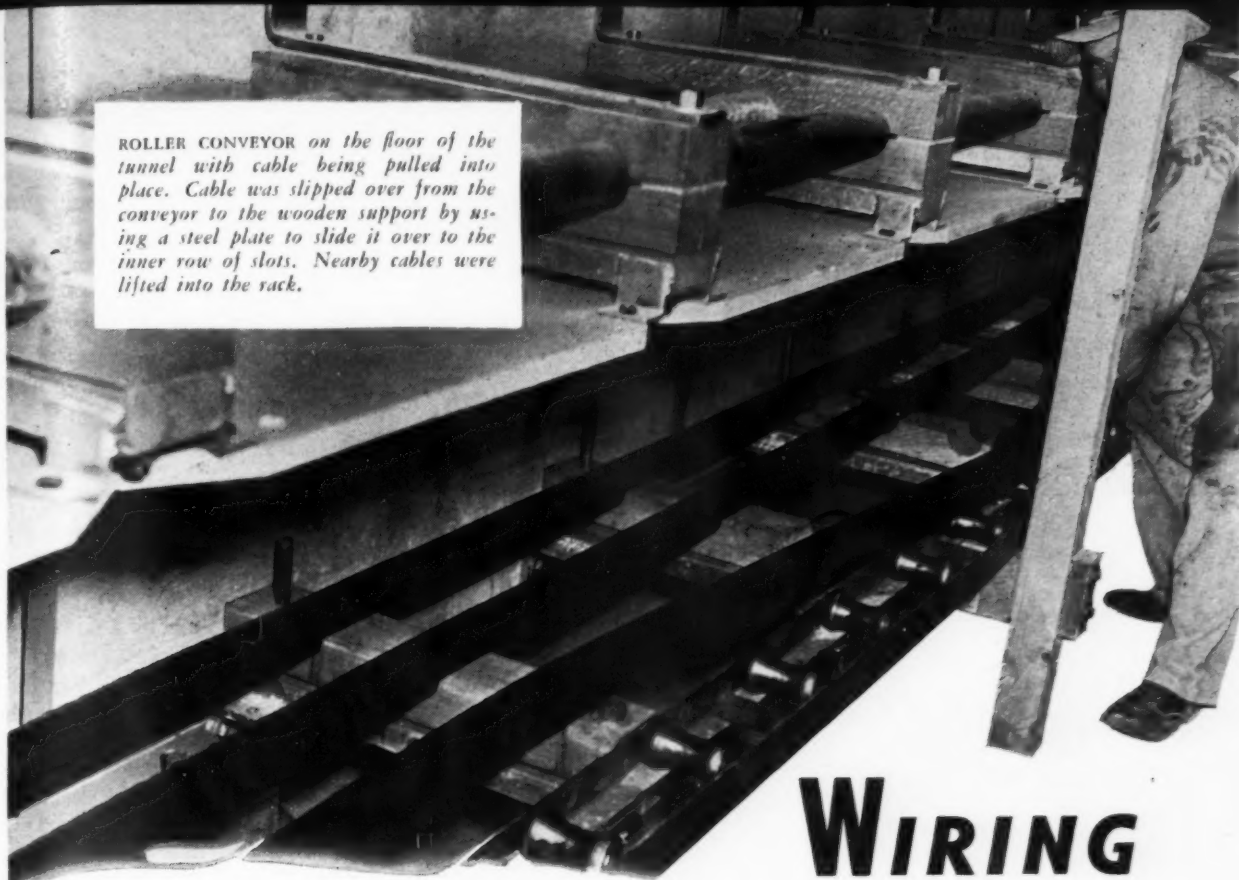
In the coming peace to which we look forward hopefully, we shall find a new world full of new materials, new conveniences, new jobs, new opportunities, all stemming out of the present-day work of the chemical engineer. The same tough, transparent plastics that now make noses for bombers will give us new frameless windows for our homes and automobiles. With capacity to produce at least 2½ billion pounds of aluminum, which is five or six times pre-war production, and a magnesium capacity 50 or 60 times the pre-war figure, many new uses will develop for these structural materials of great strength and amazing lightness. Almost anything that flies, runs, moves, or otherwise is motive, will have a place for them. New fibers such as nylon and vinyon had scarcely got started before they were put to war use. Once the war is over they will be with us in greater abundance and at lower cost for a variety of uses so vast and so diverse that we can scarcely imagine them.

And the chemical engineer continues to create and to invent. He meets the challenge of scarcities and shortages with ever new "substitutes" that excel their originals. Even before the war is over he will have placed at our command a hundred new materials which we did not have before. His workshop is all industry. His contributions are as limitless as are our needs.

But right now his all-important job is to help win the war; to fight to a finish the ruthless and resourceful enemies that are devoting all their science and technology to bring about our defeat. So, as we take stock of our assets in this desperate struggle, we count among the first the proved resourcefulness of the research-minded chemical engineers we now have mobilized to help us fight this chemical war.

*James H. McGraw, Jr.*

President, McGraw-Hill Publishing Company, Inc.



ROLLER CONVEYOR on the floor of the tunnel with cable being pulled into place. Cable was slipped over from the conveyor to the wooden support by using a steel plate to slide it over to the inner row of slots. Nearby cables were lifted into the rack.

## WIRING AT BASIC MAGNESIUM

**B**ASIC Magnesium, Incorporated, is almost in operation. Although its site, last September when one McNeil Construction Co. began work was a raw southern Nevada desert, the project has proceeded in record-breaking time by virtue of careful engineering and skillful job organization. Basic Magnesium, Inc., will soon be turning out large quantities of magnesium to supply the war production program of the United States, from a huge plant covering several miles of desert with electric power supplied from Boulder Dam.

The engineering for the project was handled by Basic Magnesium's own engineering staff under the general direction of G. B. Kaufmann, originally, and now under T. R. Cook, manager of engineering, with W. R. Battey, formerly of Southern California Edison Co., in charge of electrical engineering, and W. B. Dyer, in charge of mechanical engineering. Another former Edison man, E. M. Scott, General Superintendent of Electrical Operations, formerly Asst. Chief Electrical Engineering, also was active in the electrical design.

From an electrical construction standpoint, and that phase only will be considered here, the vast size of the project

*Tremendous quantities of wiring materials and electrical equipment for all-out production of magnesium are installed in this great plant at Las Vegas.*

**By W. A. CYR**

and its location introduced many interesting factors including:

1. Volume of material and organization to handle it.
2. Size of equipment, cables and bus-bars installed.
3. Shortage of skilled manpower.
4. Demand for speed in completion of the work.
5. Distance from supply bases for materials.
6. Desert conditions with the handicaps of heat, wind, dust and lack of housing.

Field installation was carried out by the McNeil Construction Co., of Los Angeles, under electrical superintendent C. J. Bennett, of Bennett & Forsberg Electrical Co., electrical contractors of Los Angeles. On his staff, Bennett had several electrical contractors and elec-

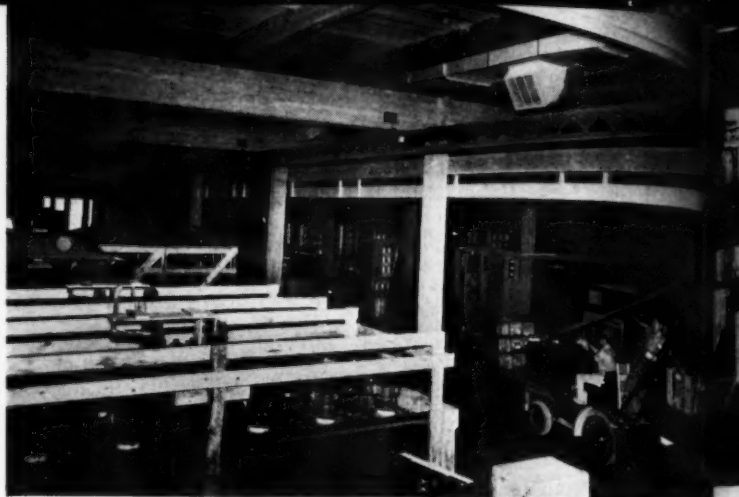
trical maintenance engineers from southern California in key positions to handle parts of the work and the supervision. J. E. Irwin, of Los Angeles, for example, handled the wiring of the village of homes built by the company on the project.

The transmission line between Boulder and the plant, the high-tension substations and the water pumping stations were engineered by J. M. Montgomery & Co., Los Angeles, and installed by Fritz Ziebarth, Long Beach, Cal., electrical contractor.

The method used for reducing magnesium ores, which are hauled some 300 miles distance, involves extensive preparation yards and buildings, chlorination, electrolysis, conversion, foundry, and shop buildings which require a large variety of motor installations from



ASBESTOS SHEETS, one inch thick separate tiers of 13.8 kv cables in the distribution tunnel.



CONSTRUCTION WAREHOUSE contained offices and storage. This big building is for the electrical department and shop alone.



RECTIFIER ROOM in the metals building during assembly of these units.

fractional horsepower to 250 hp. a total of over 1000 motors in all.

An idea of the size of the electric job can be had in that the energy required might supply lights and power to a city half the size of Los Angeles. This installation involves 230 kv. transmission lines, 230/13.8 kv. substations, runs of 13.8 kv. 2,000,000 circular mil cables in long tunnels, switchgear installations for motor generators and rectifier units, transformers and busbars for electric furnace, and a large volume of heavy copper busbars for the electrolysis cell circuits. This takes several thousand tons of copper for the installation.

There are several 13.8/4.16 kv. distribution substations which care for 90 per cent of all the preparation, shop and administration areas, and there are numerous 4160/440 volt unit substations taking power from the distribution system and furnishing it directly to the load centers in the various buildings. In addition to the unit substation, there are large quantities of power and lighting wiring installed for the extensive spread of buildings.

Manpower employed in the electrical work alone was in proportion to the entire job. Bennett had 800 men working on the installation, of which 600 were electricians. The rest were underground men and laborers. This does not include 75 or more machinists in the busbar shop. An additional 250 or more electrical men could have been used were they available.

Although skilled men were few, they were placed in supervisory positions. Then, each type of operation was studied, a method developed to handle it, and sufficient time taken to train a crew to become adept with that particular kind of job. From then on that crew was kept on that type of operation continuously until the job was complete.

"It takes a little longer to get them started", said Bennett, "but it is worth it. Green men, once taught to handle a certain list of operations, can do the work just as well as more skillful men if they are kept on the one operation with which they are familiar."

To handle efficiently the large size copper busbar and the heavy cables em-

ployed, required planning and organization, too. Main feeders from the substations serving the plant consisted of 2,000,000 circular mil cable. Power received from Boulder over the transmission lines is stepped down to 13.8 kv. at primary substations, and then stepped down to 4160 volts for plant distribution. From the substations, distribution is three wire, delta, underground cables being laid in especially treated hardwood block separators on racks, two or three decks high, in tunnels.

Outside diameter of this cable is approximately three inches, and there was many thousand feet of it to be laid in the tunnels. This called for an ingenious construction method developed by Bennett. To facilitate pulling such large cable and to lay it on the racks, each cable in its own series of supports, Bennett obtained, after some difficulty, an ample number of sections of portable roller conveyor. As the cable was pulled from the large reel on the ground above, down through the manhole, the cable was laid upon the rollers and pulled along with comparative ease.

To slide the heavy cable from the roller conveyor to its particular rack, a steel plate was laid across the wooden spacers. It was comparatively easy to slide the heavy cable over the steel plate into its respective notch. Sections of conveyors, about 10 feet long, were spaced sufficiently close together to permit easy rolling of the large, stiff cable.

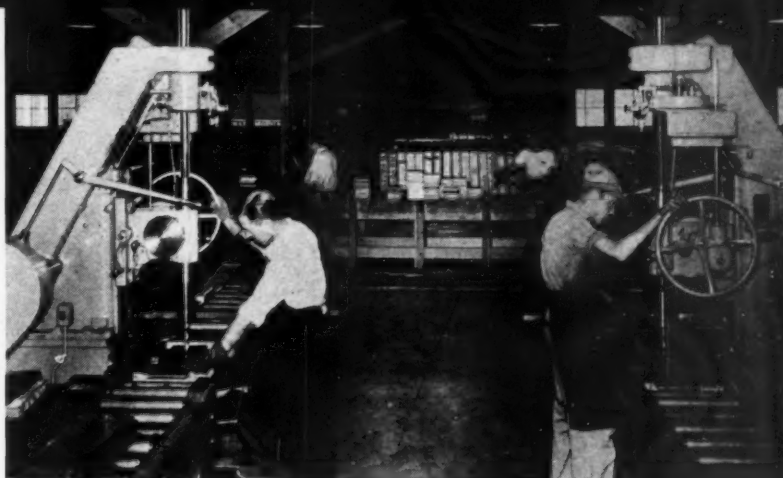
The cable tunnels are of concrete, approximately eight feet high and six feet wide. Steel racks attached to the side walls, separated by a 1-inch transite sheet, support the hardwood spacers.

The quantity of busbar work was exceptionally large. Several thousand tons of copper  $\frac{1}{2}$  inch by .8 inches was used on the job to carry direct current at 350 volts from the motor generator sets or rectifiers to the electrolytic cell blocks. Copper busbar used in the electrolysis units was ganged up, six to a





HEAVY COPPER busbars stacked up ready for assembly. Ordered to 1/16 inch dimension accuracy.



DRILLING AND FORMING heavy copper bus in a well equipped temporary shop with precision equipment.

bus, spaced  $\frac{1}{2}$  inch apart. Opportunities were found by which substantial savings could be made in copper, as well as expense, by more careful planning of every piece of busbar.

Specifications and drawings were made in elaborate detail for every piece of copper. A dummy cell was set up, the busbar fitted to it, and revisions of the drawings made after trial assembly. This permitted a fraction of an inch saving in busbar length on each piece. Over several thousand pieces, this amounted to many pounds of copper. A further economy was made by using spacers of pressed board, especially treated, instead of short pieces of copper busbar, to keep the buses spaced  $\frac{1}{2}$  inch apart.

Cable, too, is ordinarily taken at mill standard lengths and cut in the field for installation. Size of this job and large tonnage of copper enabled material savings in cost and in copper by having cables cut to exact length at the mill. It was estimated that a saving of 400 tons of copper was made, for an estimated saving of \$150,000 on the waste copper alone by this procedure, plus labor cutting cost.

Busbar was furnished to the job flat. Stacked up in the bending shop, it resembled piles of lumber, so much of it was used. Jigs were prepared and accurate measurements made so that every piece would be bent exactly as required, holes bored accurately and lengths kept equal to eliminate unequal electrical stresses.

In the substations used for power and lighting throughout the group of buildings, the capacity ranged from 300 to 2000 kva., each of the unit type. On the high side, they are supplied with 4/60 volts, which is stepped down to 440 volts, 3 phase, 3 wire, for power and 4160 volts to 440-254 volts, 3 phase, 4 wire, for lighting. Two of the power substations take 13.8 kv. to 480 volts. Each cell electrical building has its own

conversion substation which receives 13.8 kv. power over the 2,000,000 circular mil distribution cables and rectifiers providing 350 volts, d.c. In some buildings rectifiers are used, and in others there are motor generator sets. The selection of equipment was dependent on the manufacturers capacity to supply them.

Because of its location in the desert, and high altitude, the tendency for static charges of electricity to build up considerable potential is guarded against by an extensive grounding and bonding system. There are many wells located at various parts of the property, driven from 50 to 200 feet in depth to find water. A three inch copper pipe is run down in each well to water. Main ground wires are carried on 1,000,000 circular mil cable and to this, all buildings, metals, railings, and equipment is connected. Disconnecting means are provided at each of the wells to separate it from the grounding system and to permit testing.

Thus, the factors in this huge job

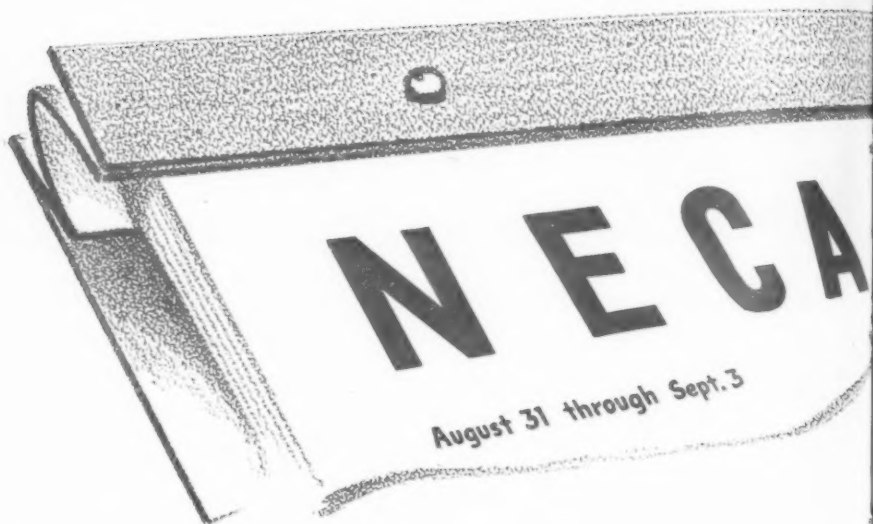
E. W. SCOTT, general superintendent of electrical operations for Basic Magnesium, Inc. (Right)

CLARE BENNETT, electrical contractor who handled the electrical installation for McNeil Construction Co. (Lower right)

JOHN GILL BODDY, electrical engineer from England, supervising the electrical design of the plant. (Below)

were handled. Volume of material was handled, by organization of the job into units and training crews to handle each part. Shortage of manpower was met by better organization of crews and training. Time limits were met by speed of the work and efficiency in planning. Desert conditions were beaten by getting small air conditioning sets and installing them near where the men were working, plus the provision by the management of every facility to alleviate the heat, dust, and housing shortage.





**T**HE 1942 convention of the National Electrical Contractors Association at Bigwin Inn, Lake of Bays, Ontario reviewed the urgent problems of an industry at war. Able speakers from within the industry and from new wartime government departments, whose actions are of vital and immediate interest, explored the roster of federal regulations, the rapidly changing materials and standards required by limitations on metals and rubber, and the personal and business responsibilities of electrical contractors in prosecuting the war.

Behind the scenes, in the lobbys and in the small groups that gathered to trade experiences and opinions, there was the militant spirit of an industry

handling the greatest volume of electrical construction work of all time. There was short tempered belligerence for those who would use the national emergency to "muscle in" on the electrical construction industry at public expense. There was a note of willing sacrifice if it were necessary to win the war, but a critical attitude toward unnecessary, wasteful or uselessly crippling regulations. There was a ready willingness to adapt to any compromise in standards that would expedite war production. There were discussions of joint ventures, of labor relation problems and apprentice training. The broad picture was that of an industry all out in the service of its Nation.

#### Monday

George W. Patterson, NECA Executive Committeeman for Canada welcomed the delegates at the opening session on August 31. He expressed gratification that so many industry leaders could attend in spite of their heavy business responsibilities in these times.

Robert W. McChesney, President, in his address to the convention and Lawrence W. Davis, General Manager, in his annual report, reviewed the past year's progress in the activities of the Association.

Reporting on the expanded facilities available to members in Washington, Mr. McChesney reviewed the efforts made two years ago to establish adequate representation and facilities in the capitol. He said, in part, "War activities since 'Pearl Harbor' have demanded that the industry be represented in Washington by an experienced full-

#### TOP TO BOTTOM

*CODE DETAILS are given the once over as (L to R) H. C. Evans, Kansas City; George Andrae, Milwaukee; and A. M. Barrett, Kansas City, discuss K.C.'s new electrical code.*

*RE-ELECTED EXECUTIVE committeeman W. Edward Frazer, Philadelphia (left), chats with fellow contractor Stan Cameron of H. P. Foley Company's Philadelphia office.*

*CONGRATULATIONS ARE offered A. L. Stone, Los Angeles (left) on his re-election as NECA executive committeeman from the west coast. Well wishers are W. J. Varley and Clyde Chamblin both of California.*

*GOOD SAILORS C. C. Cadwallader and Norman A. Grams, both of Detroit, enjoy the boat ride on the first leg of the journey home.*

*RUBBER SITUATION is discussed by C. W. Higbee (left), U. S. Rubber Co., N. Y.; O. F. Wadleigh, Sanborn Electric Co., Indianapolis; and H. J. MacDonald, U. S. Rubber Co.*

*FROM BUFFALO came (L to R) G. F. Butler, Beacon Electric Co., and C. J. Schwab, Buffalo Electric Co., for the NECA sessions*



# Convention Report

**Contractors wartime regulations, responsibilities, and expanded IBEW Employers Section activity highlight the 41st Annual Convention at Bigwin.**

time staff, equipped to act on a moment's notice, and in the field by at least two or three capable representatives. Many of you members are familiar with a few of the many problems which have affected your interests. The demands, both from the government and from the membership, upon your officers and committeemen were impossible of accomplishment with the staff and funds at their disposal. Appreciating the danger of this most serious situation, the IBEW Employers of the Association came to our assistance through the Labor Relations Committee, and provided, by increasing their special fees, sufficient funds to establish a well-equipped office with capable personnel and two competent field men.

"Under Mr. Geary's supervision there has been placed in the field two representatives to protect electrical contractors' interests in the various localities and to cooperate with the many government district offices which have been established as a result of the recent decentralization plan of several of the Federal Departments. More of these NECA Field Representatives will be employed just as soon as competent personnel is available and our funds will permit. The personnel in the field today includes the following: W. J. Varley, formerly manager of the San Francisco Chapter, Western Representative; Dwight L. Casey, formerly manager of the North Carolina Association of Electrical Contractors, Southeastern Representative.

"More than doubled within the past year, NECA's office staff and field men are in constant contact with government

representatives, demanding justice for the electrical contractor and assisting in every possible way to win the war—and win we must."

Activities of the Association have been keyed directly to the war effort, it was reported. Some have been curtailed or discontinued for the duration.

**Sales Development**—The importance of a sales development program is recognized and a reserve fund is being established for post-war activities.

**Statistical Surveys**—Abnormal conditions do not warrant too much expense and effort in assembling and publishing statistics, but the Association is conscious of the value of statistics on some phases of the industry at this time and these are being compiled.

## TOP TO BOTTOM

**MILWAUKEE DUO** E. H. Herzberg (left), now of Washington, D. C., and Walter J. Robn, discuss Ed's favorite topic—apprenticeship training.

**FROM DEEP SOUTH** Walter J. Barnes, New Orleans, La., and Eugene Asbe, Fort Worth, Texas, made the trek into the heart of Canada for the NECA meeting.

**MRS. GEORGE PATTERSON** (right) describes Canada's beauties to Mrs. W. W. Hanks, Charlotte, N. C., on the scenic boat trip to Huntsville.

**COULD BE**, surmises H. F. Janick, Rochester, N. Y., as he listens to a story told by W. P. Collins, Springfield, Mass.

**CAREFREE MOMENTS** of relaxation are enjoyed by Paul Geary and Ernie Carlson after a busy morning at NECA's Bigwin meeting.

**TAX PROBLEMS** occupy the after-session leisure of contractors A. Herrmann Wilson, Washington, D. C. (left) and Robert A. Goeller, New York City.





## Emergency Substitute Materials

ALVAH SMALL,

President, Underwriters' Laboratories, Inc.



**A**BOUT the middle of 1941, Underwriters' Laboratories changed its requirements to recognize substitutes promulgated in Emergency Alternate Specifications of the Federal Specifications Board. This was a practical procedure because the government had become industry's biggest customer and the specifications were changed only after conferences with the industry. In some cases F.S.B. requirements are merely a reference to a U. L. standard.

Electrical contractors will recall that steel parts, copper or brass plated, were accepted for panelboards, switches and other products during the last war. It recently became necessary to take this step again to conserve copper. Now emergency standards permit the substitution of steel, plated or otherwise protected from corrosion, in the assembly of current carrying appliances unless the part is involved in making or breaking a circuit.

After Singapore, U. L. requirements for the performance of rubber insulations in the oxygen-bomb test were modified to permit the use of much less crude in compounding.

Electrical insulation is fundamental. There should be no slighting of protection from personal injury or other phases of the shock hazard, and heating effects are the result of Ohm Law for which there is no wartime substitute, same softening of judgments of the significance of a particular performance may be warranted.

## STREAMLINING INDUSTRY AND COMMERCE

ARTHUR L. BROWN,

Administrator Electrical Equipment and Supplies, Wartime Prices and Trade Board, Ottawa



**C**ANADIAN price control which froze prices on Oct. 1, 1941 has succeeded in limiting the price spiral to 2.2 points since. Electrical apparatus, equipment and supplies is controlled under one Industry Administrator. The headquarters of the board has several divisions including prices, distribution, and rationing, and simplified practice.

Through the simplified practice division is coordinated the simplifying and streamlining of industry and commerce to meet the problems of war. Administrators have Advisory Committees to act as liaison officers between themselves and each industry group, such as wire and cable, commercial and industrial lighting, wiring devices, etc. Thus the industry itself is working willingly and unselfishly to achieve the purpose we have in mind.

In the post-war period I should like to see the entire electrical industry formed into one great association. In this there might be five divisions; Engineering, Manufacturing, Installation, Power Distribution and Merchandise Distribution. Its entire membership should be firmly convinced that the first duty of an industry is its service to the people.

**Codes and Standards**—War regulations have upset much of the work accomplished by the Codes and Standards committee under Chairman George Andrae. The committee is cooperating closely with NFPA and government bodies to expedite emergency Code revisions and substitute materials to meet the extraordinary conditions brought about by wartime scarcity of certain critical materials.

**Estimating and Cost Data**—Uncontrollable conditions have affected all estimating and cost data. However, the committee is furnishing what it has with a warning that an additional factor to cover existing abnormal costs must be added to their units.

**Apprentice Training**—Late last year NECA in conjunction with the IBEW and with the assistance of the Federal Committee on Apprenticeship, U. S. Department of Labor, promulgated National Apprenticeship Standards for the Electrical Construction Industry. Those Standards have since been published by the Department of Labor. The inauguration of those National Standards is but the first step toward the objectives for which the standards are designed.

A productive apprenticeship program that will bring in a constant flow of young and thoroughly trained workers is vital to the welfare of our industry; every electrical contractor, therefore, is obligated to sponsor and support such a program in his locality. The importance of apprenticeship training in the war effort cannot be over emphasized.

**Labor Relations**—Never before in the history of the IBEW and NECA have the relations between the two organizations been more cordial and more cooperative, and that spirit and practice exists between most locals and chapters. The speed in which the enormous amount of electrical construction has been executed during the past few months by the combined membership, is concrete evidence of the cooperation that exists between them.

Nine obligations of the electrical contractor in these times were listed reflecting the new conditions the industry must meet in its relations with government, the public and labor. They are:

We must cooperate with and support all of the Government Agencies which are charged with the execution of this war.

We must understand the vast and far-reaching Government regulations.

We must conserve and salvage all critical materials so vital to our war production.

We must cooperate with and assist our allies in the terrible conflict which has the entire World in its grasp.

We must cooperate with the IBEW in the furnishing of sufficient skilled workers to produce the work required of the industry.

We must better the excellent performance records of rapid production which we have already established.

We must strengthen our Association so as to make it of the greatest value to our Government and to our industry.

We must assist our fellow contractors who face annihilation due to the elimination of private work and direct their services to the war effort.

We must provide now for post-war activities. While "first things must come first" and the war is first, we cannot afford a catastrophe after the war.

Following the official reports, E. H. Herzberg, Executive Assistant to the President, Washington, D. C. reviewed in detail the organization of the Washington office and the services it performs for NECA members. Paul M. Geary, Field Supervisor discussed the procedure of the field staff and the problems they can help to solve.

The impact of the war on the Cana-

PHILADELPHIANS CHAT to a neighboring contractor at Bigwin Inn. (L to R) D. J. Crimmins, New York City; W. H. Biester, Jr.; W. F. McCarter; Louis Robinson and E. E. Hedler, all representing the Quaker City at the NECA meeting. (Top)

SOUTHERN LADIES who made the long journey to the Bigwin meeting included (L to R) Mrs. John Pearson, Richmond, Va.; Mrs. James Richardson, Roanoke, Va.; Mrs. K. D. White, Atlanta, Ga.; and Mrs. George Jeweman, Birmingham, Ala. (Bottom)



dian electrical industry and what the industry is contributing to the war effort was described by Morris J. McHenry, Sales Promotion Manager, Hydro-Electric Power Commission of Ontario, Toronto.

## Tuesday

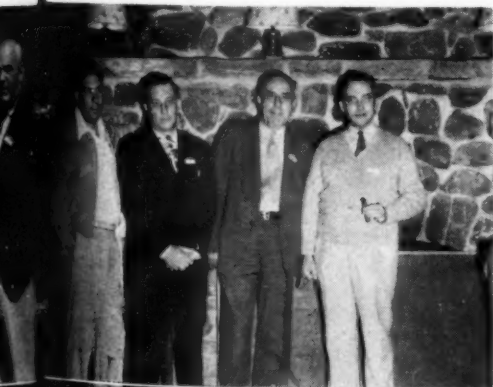
The second meeting tackled the problems of the IBEW Employers section and the vitally important labor relations and stabilization work carried on in cooperation with the International Brotherhood of Electrical Workers.

Erne C. Carlson, Youngstown, Ohio, chairman of the Labor Relations Committee, pointed out the strategic importance of skilled labor in carrying out the tremendous building program thrust upon our industry by the war. He decried the efforts of other contractors to take over the expanding field of electrical construction, and establishing electrical departments by setting up and training management staffs at government expense on fee contracts.

E. J. Brown, president of the International Brotherhood of Electrical Workers, reviewed the policy of his

ST. LOUIS GROUP at NECA's Bigwin meeting included (L to R) contractor representatives G. L. Gamp and R. E. Vierbeller; H. J. Reinhardt, Frank Adam Electric Co.; and J. C. Ingram, Bussmann Mfg. Co. (Top)

CINCINNATIANS J. C. Kunzelman (left), Charles Ginn, P. M. Wray, and Charles M. Beltzboover represented the Cincinnati electrical contractors at NECA's Bigwin convention. (Bottom)



organization in cooperating with NECA officers in Washington and over the country. The IBEW, he said, is in sympathy with the position of the specialized contractor on war construction projects.

Joseph D. Keenan, Associate Director, Labor Production Division, WPB lauded the joint efforts of management and labor in the electrical construction industry to maintain sound and stable labor relations. It is a grave responsibility, today, he said, for labor to work closely and harmoniously with management in the war effort. Under rigid wartime regulations, he stated, restrictions such as L-41 are forcing many contractors out of business. Government and industry, he implied, have a moral responsibility to see that all essential electrical work be handled by skilled electrical contractors.

Arthur L. Brown, Administrator of Electrical Equipment and Supplies, Wartime Prices and Trade Board, Ottawa, Canada, paralleled and contrasted the war regulations of Canada and the United States. He described the Canadian methods of rationing and price control which have been in effect longer than similar regulations in the U. S.

Two wartime necessities in the electrical industry should be carried on after the war, he stated. One of these regulations prohibits sales to consumers at wholesale prices, the other effectively standardizes many electrical products.

For the future, as a major post-war project for all the electrical industry, he urged the establishment of an "American Electrical Federation" on a continental scale. This organization should work to bring the benefits of our combined electrical resources to all the people of the Americas. He suggested operating with five branches; design and engineering, manufacturing, installation and application, power generation and distribution, and merchandising, correlating their individual progress in the all-industry group.

A whirlwind one hundred day campaign in the Far West for NECA membership was described by Wm. J. Varley, Western NECA Representative in San Francisco. He reported a large increase in membership for that area and the successful organization of several "joint venture" projects to carry out large government construction jobs. He urged better understanding of the responsibilities of labor relations and asked for industry cooperation.

## Wednesday

General Henry P. Seidemann, Deputy Director General, Army Specialists Corps described the organization and

## THE ARMY SPECIALIST CORPS

GEN. HENRY P. SEIDEMANN,

Deputy Director General Army Specialist Corps, Washington, D. C.



ONE of the serious bottlenecks in this war is our supply of officers with professional military training. We cannot afford to waste a single one on duties of any other nature. Yet the army must be clothed and housed and fed and moved. Capable engineers and business men can be used to carry on this work but they must do it as officers under military command. This is why the Army Specialist Corps was formed.

The most acute shortage of engineers is in the electrical line. Men with special training in various electrical techniques are needed by thousands.

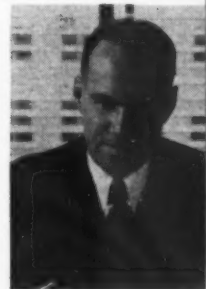
The objectives of the Corps are, briefly:

1. To bring under the control of the Secretary of War certain skilled individuals who have the required qualifications to enable them to perform duties of certain military personnel, thereby relieving the latter for combat and command duties.
2. To add to available manpower by using men over-age or not physically qualified for active military duty.
3. To supply all arms and services and other agencies of the War Department with individuals possessing certain professional, scientific, technical and administrative skills.
4. To train such persons whose educational background qualifies them to receive training in fields wherein the demand for trained personnel exceeds the supply.

## APPRENTICESHIP TRAINING SPARKS WAR

W. F. PATTERSON,

Chief, Apprentice-Training Service, War Manpower Commission

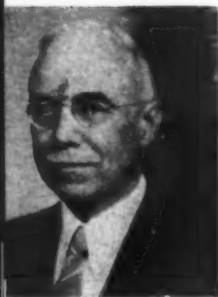


OUR whole war effort revolves around the question of more thorough and effective utilization of our nation's manpower. The electrical industry, through its Apprentice Training has made a vital and far-reaching contribution toward expediting this utilization. When last August, after three years of intensive labor on the part of a joint contractors-workers apprenticeship committee, national standards were officially launched, I considered it a historically significant occasion. These are to be used as a guide to set up local programs.

We cannot too heavily stress the current importance of local joint committees. Since the national standards were completed, the number of local programs has increased by one-third, now totaling 100. Approved programs are now found in 30 different states. Eighteen states have no local programs. As materials become harder to get, the skill of the craftsman will gain in importance as the electrical contractor's chief stock in trade. The craftsman who has been thoroughly and soundly trained through apprenticeship grows in value and will be able to make more effective use of limited supplies available. As the draft and more lucrative opportunities cut deeper into the supply of trained electricians, more expert use must be made of older workers.



## CONSERVING OUR VITAL RESOURCES



DEAN HARVEY,

*Chief, Electrical and Mechanical Section, Specifications Branch, Conservation Division, WPB*

**A**S existing supplies of materials are exhausted, we often will not have the manpower or the manufacturing facilities to replace them in kind. The public must utilize in their stead whatever substitute materials are available. Our fourfold program for conserving our vital resources includes: 1. increasing production to provide a large supply 2. using critical materials where essential 3. effectively applying critical materials; 4. saving critical materials by elimination of waste. The first is accomplished through industry and WPB; the second through limitation orders and priorities; the third through substitution simplification and standardization; the fourth through the Salvage Branch of the Conservation Division, WPB. Contractors can do their part by: 1. seeing that electrical installations use the least amount of critical materials; 2. educating electricians and others to save all metallic materials; 3. saving all odds and ends of wire and insulation and rubber; 4. cooperating with local salvage committee and seeing that scrap gets back to salvage stockpile; 5. making periodic inspections of installations to keep them in first class condition; 6. substitution of old-time materials and used equipment where possible. It is necessary for us to adapt ourselves to the new conditions and to aid most effectively in the war effort.

## Stabilization of Employment



JOSEPH D. KEENAN,

*Associate Director, Labor Production Division, War Production Board*

**M**ANY business firms have had to face drastic changes. Organized labor also has a new role in public life. Traditionally concerned with improving conditions and wages, they now have the responsibility of cooperating with management to produce and transport the materials of war to the utmost limit of our capacity. These responsibilities are being recognized and accepted.

I am in accord with the principle that contracting agencies request the utilization of specialty sub-contractors on those parts of the work which are under normal contracting practices performed by specialty sub-contractors. This policy has been upheld by the House Military Affairs Committee with respect to all war construction contracts. It can materially contribute to winning the war. Only if the pattern were one which was proving slow or costly could there be made a reasonable cause for changing it in time of emergency.

It has required years of negotiation and public education to develop the standards of this industry. NECA and IBEW have long had an active interest. These standards should be maintained to give full protection to government property and they should be maintained to prevent the lowering of standards in private construction after the war.

the duties of the Corps. It is the answer, he said, to those with specialized skills who want to know how they can best serve the war effort.

"Many have offered their services to the government and have been turned down for commissions because of lack of military experience," he said, "and others have not offered their services because they do not understand how the army could make use of their particular qualifications." The Army Specialist Corps, he continued, provides for the efficient use of professional talent as officers under military command and with military responsibility.

This war, he said, might be called an engineers war or even an electrical engineers war. Almost every piece of war equipment is electrically controlled or has important electrical parts. He urged those contractors who could get away from their own business without impairing essential production to offer their services to the A.S.C.

In a stirring inspirational address, Col. O. R. McGuire, NECA General Counsel, reviewed the great economic adjustments and business prospects in the days after Victory.

Business prospects may become good, he said, if businessmen succeed in abolishing poverty by restoring equality of economic opportunity and placing greater purchasing power in the hands of consumers.

Politicians cannot solve our economic problems, he continued, but if business, labor and the farmer join hands and lay aside their greed and reconcile their economic differences, greater purchasing power can be placed in the hands of the consumer—purchasing power that can and will be used for the greater output of farm and factory.

It should not be difficult for business, labor and the farmer to attack and solve this economic riddle of all ages—abolishment of poverty from the face of the globe, he concluded.

Progress in the development of substitute materials was outlined by Alvah Small, president of Underwriters' Laboratories. Enamel and paint finishes are replacing zinc coatings of raceways, outlet and distribution center hardware, and shortage of cadmium and chromium has made it necessary to accept, for the duration, phosphate treatments as a first step for the final lacquer or paint finish, he said.

Tin shortage, he continued, has required the consideration of lower grades of brass substitutes for the coating of wires and new mixtures of solder. Nickel is no longer used for heating elements but still obtainable for bi-metal control parts.

To assist in the conservation of copper Mr. Small reported that emergency alternate standards permit the use of steel in the assembly of current carrying appliances unless the part is actually involved in making or breaking a circuit.

Changes in the National Electrical Code are reflected in the operations of Underwriters' Laboratories, he stated, citing the fixed policy that the Laboratories not be recorded as endorsing products or methods that involve violations of the Code. Proposed emergency substitutes must meet this requirement.

George Andrae, chairman of the Codes and Standards Committee reviewed emergency changes in the National Electrical Code and revised specifications of electrical wiring materials.

Among the important changes he noted were the return to type R code grade wire using the 1937 Code values for current capacity, the substitution of enameled tubing for conduit and the introduction of interlocked armored cable.

Bus systems under present conditions are saving steel, copper and rubber in industrial electrical construction, he continued, pointing out the high salvage value and high current to copper capacity of such installations. The development of transformers with non-inflammable liquids and air-cooled types for interior use has opened the way for redesigning industrial wiring systems for high voltages and consequent reduction in copper sizes, at the same time improving voltage conditions, he stated.

In concluding his discourse, Mr. Andrae urged the contractors to exercise special care to preserve the standards of safety which have been built up over a period of fifty years.

## Thursday

"The Local Joint Committee becomes the guardian of the apprentice," stated E. H. Herzberg, chairman, National

SMILING TRIO who decided not to be convention widows are (L to R) Mrs. George L. Gamp, St. Louis; Mrs. George Andrae, Milwaukee; and Mrs. Eugene Asbe, Fort Worth, Texas.





Joint Committee on Apprenticeship Standards, during his evaluation of apprenticeship training committees. "For the first time in the history of the modern Building and Construction Industry, we have a national training program that works. The number of local apprenticeship programs for electricians set up and approved for June of 1942 was 98 as contrasted with 75 for June of 1941. This gain was made in spite of the confusion within the building and construction industry due to the great war construction program calling for speed and size of projects previously unheard of", he continued, outlining the progress made in the apprenticeship training field.

A glowing tribute was paid the Electrical Construction Industry by W. F. Patterson, Chief, Apprentice-Training Service, War Manpower Commission, during his discussion of the importance of apprentice training to the war effort. "Our whole war effort revolves around the more thorough and effective utilization of our nation's manpower", he stated, "and the electrical industry has made a vital and far-reaching contribution toward expediting this utilization." He commended the members of the National Joint Apprenticeship Committee and the cooperation of industry and labor in training new men for skilled jobs, and the development of the National Apprenticeship Standards for the Electrical Construction Industry. Approved programs are now found in 30 different states, he noted, leaving an undeveloped field in 18 states for more local committees. "If contractors want to safeguard their future reputations, they can not afford to neglect the training of apprentices no matter what obstacles lay athwart their paths today or in the immediate future", he said.

Speaking on the conservation of our vital resources, Dean Harvey, chief, Electrical and Mechanical Section, Specifications Branch, Conservation Division, WPB, cited ways to achieve the four objectives of the conservation program, namely: increased production, use of critical materials where essential,

effective application of critical materials, and savings of materials through elimination of waste. "You have already accomplished much", he concluded, "and we are counting on you to do everything you possibly can do."

### Business Section

The last half of Thursday's session was devoted to Association business. The first on the calendar was the review and approval of proposed amendments to the by-laws of the association. These covered activities, fiscal year and dues as related to gross sales, fixed fee contracts, joint ventures and special benefit activities.

Elections at this meeting were confined to choice of executive committeemen for Div. 3 (Penn., Del., Maryland, and Dist. of Columbia); Div. 6 (Mich., Ind., Ill., and Wis.); Div. 9 (Calif., Nevada and Arizona). W. E. Frazer, Philadelphia, was reelected as Div. 3 committeeman, J. N. Pierce for Div. 6 and A. L. Stone, for Div. 9. Other officers, including R. W. McChesney, president, and L. W. Davis, secretary-treasurer remain the same.

Among the resolutions presented and approved were those calling for the following: 1. Formation of an executive committee to act on suspension of dues for members in the armed services or forced out of business because of the war; 2. Appointment of a Post-War Committee of five members to study

post-war conditions of the electrical industry as a whole; 3. Setting aside as of Sept. 1, 1942, 10 percent of the association income for post war use; 4. To follow the suggestion of the Heating and Air Conditioning National Association for the formation of a National Board or Committee of all mechanical trades to aid members during the war, NECA to appoint a committee of three members to sit in on the meetings of other mechanical organizations; 5. To urge NECA to present to state legislatures a draft of a uniform bill requesting that electrical work be let on competitive bid on specifications to permit free competition among qualified contractors and to prohibit shopping of bids. This last resolution was referred to the Executive Committee for further study before action is taken.

The convention adjourned following the conclusion of the business session. No definite action was taken on the date nor place of next year's convention.

*CORNER CONFAB takes form as H. F. Fishback (left), New York; Louis Freund, New York; and H. T. Cole, Boston comment on large construction job penalties and bonuses. (Upper right)*

*HOMEWARD BOUND after a pleasant week at Bigwin Inn, these Philadelphia ladies are (L to R) Mrs. Morris Newmark, Mrs. Louis Morrison, Mrs. Bruce Ross, Mrs. W. H. Biester, Jr. and Mrs. E. E. Hedler. (Center)*

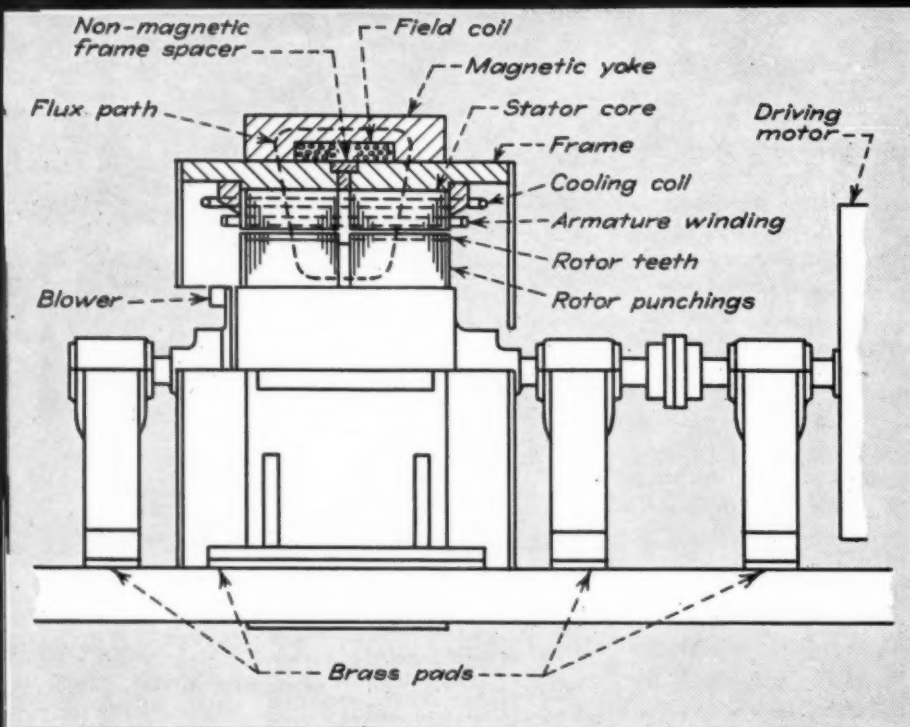
*FESTIVE MOOD is depicted by NECA dignitaries at the head table during the dinner following the convention adjournment. (L to R) Clyde Chamblin, Mr. & Mrs. E. C. Carlson, Mr. & Mrs. R. W. McChesney, Mr. & Mrs. George Patterson, Mr. & Mrs. L. W. Davis. (Lower right)*

*TASTES GOOD observes George Patterson, Toronto, as he samples and serves refreshments to Mrs. H. C. Evans and her party at the ladies afternoon bridge. (Below)*



*WORLD'S SMALLEST railroad handling passengers and freight carried the party over a portage between steamers.*





NON-MAGNETIC SPACERS force exciting flux in path shown by dotted line. Rotation produces flux pulsation in stator windings depending on number of teeth in rotor and speed.

# INDUCTION

How to operate and maintain the electrical equipment of induction heating apparatus in war industry.

By C. C. Levy, Industry Engineer  
Westinghouse Elec. & Mfg. Co.  
East Pittsburgh, Pa.

**M**ANY new applications of induction heating have recently been made, and the use of induction heating and melting is increasing rapidly. It is therefore logical that engineers who now have the responsibility for the operation and maintenance of the equipment, should be actively interested in the subject.

The maintenance of high frequency electrical equipment which is of sound design and properly installed should present no problem. Ventilation must be adequate and the air should be clean. Water is used in some cases to remove a portion of generator stator losses. The construction is such that these cooling pipes can readily be cleaned out when necessary. The control is simple, and requires no special technical training to operate since the heating appli-

cations are mainly automatic with pre-set timing for the application and removal of load, and the technique of the melting furnace operation is very simple.

Discussion of immediate maintenance problems will, however, be deferred for a brief consideration of the principles and the equipment so as to approach a real understanding of the operation.

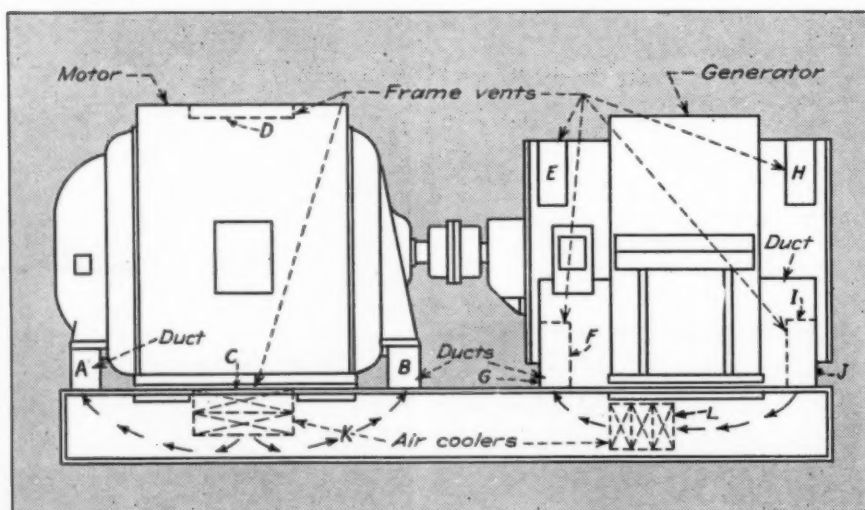
Essentially, induction heating and melting requires the combination of an inductor coil surrounding the furnace charge or work piece to be heated with a source of high frequency energy. The flow of current in the work caused by induction when the inductor coil is connected to the supply of high frequency energy is the principle source of the heat energy developed, although there is some so-called hysteretic energy

due to magnetic flux reversals, up to the Curie point at which the charge loses its magnetism. The current flows in a path the depth of which is determined by the frequency and by the permeability of the object being heated.

In all short time heating such as surface hardening applications we are concerned mainly with the depth of penetration, so that time of application of the power is deliberately made short of the order of several seconds to prevent heat from getting to other parts of the section. When we heat for forging and upsetting, longer times up to several minutes are required to permit heat conduction from the limited penetration depth in which eddy currents flow to the other parts of the section. When melting is required, this combination of conduction and induction because of the larger masses involved takes much longer time and intervals of one to one and a half hours are required.

Heating applications can also be classified as "single shot" or "progressive." In single shot heating the inductor coil surrounds the object completely and only one application of power for a predetermined time followed by the quench is needed. In "progressive" heating the coil is moved through the object as in the heating of internal diameters, or the work is moved through the coil as in surface hardening of long pins and cylinders. As would be expected the heat input in progressive heating and quenching must be very uniform and many problems of suitable control and construction of the heating equipment have to be solved.

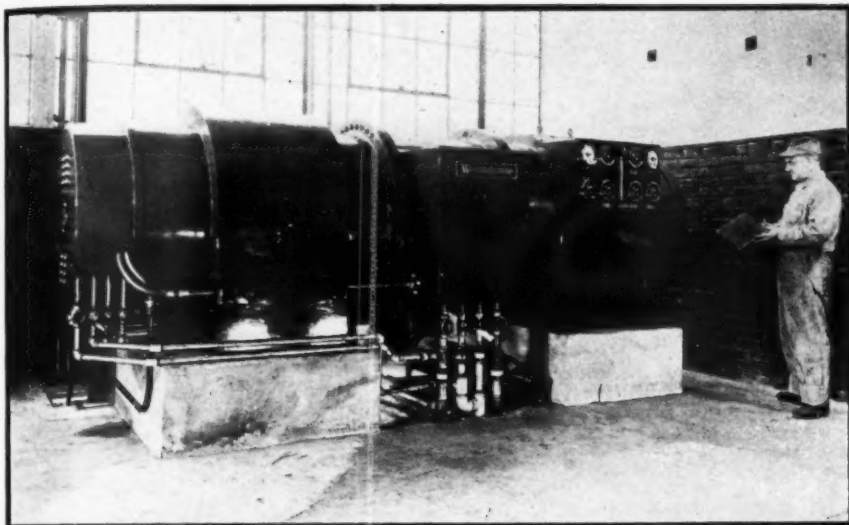
Illustrating the wide variety of the



COOLING in self-ventilated machines permits complete enclosure. Coolers may be omitted and clean air forced in from outside.



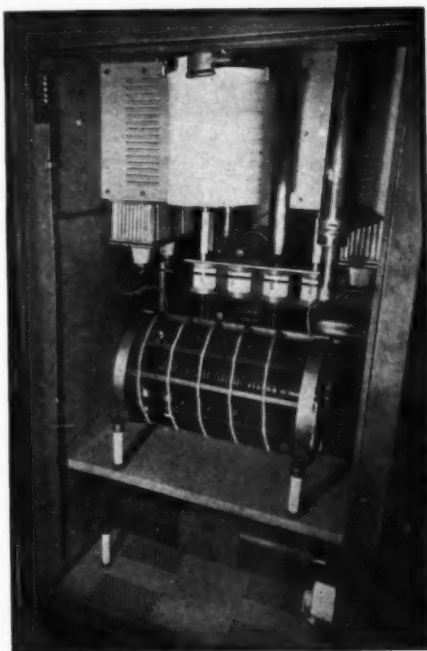
# HEATING . . .



HYDROGEN COOLED, 500 kw., 9600 cycle induction heating m.g. set is typical of power supply for large capacity installations.

applications, induction heating is used for surface hardening of rolls, crankshaft bearings, tractor pins, inside diameters of cylinders, wheel hubs, etc. Forging and upsetting applications on a large production scale are speeded up many times, thus reducing costs. Melting by induction, the earliest type of application, is particularly adapted to alloy steels where exact control or special atmospheres are necessary. Induction furnaces also have special advantages in ordnance work for centrifugal casting of guns, where metal must be melted to exacting specifications and then poured into a rotating mould. Small furnaces have also been used in refining precious metals, melting carbides of tungsten and other applications requiring high temperature. Such a wide variety of uses will naturally require a wide range of frequencies, and different types of electrical equipment.

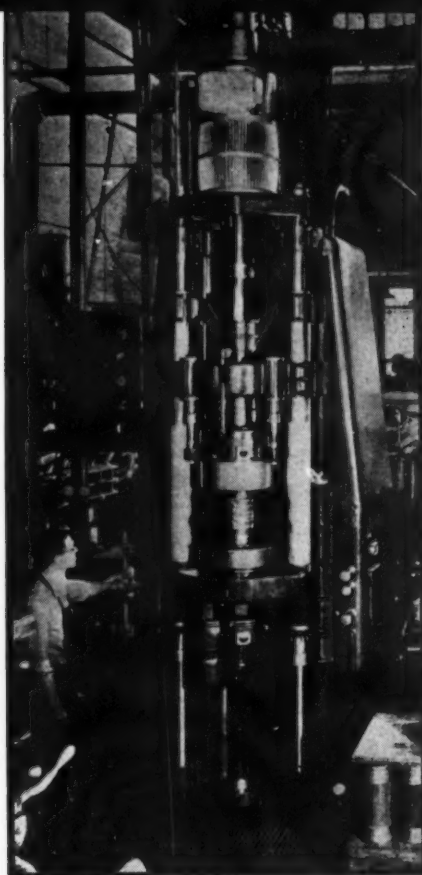
The frequency used is determined by the nature of the product and the particular process. Some standardization is necessary since it is not economical to design equipment for too many frequencies. Motor generator sets have been designed for 360, 500, 960, 2000, 3000, 10,000, and 11,500 cycles. The upper limit for rotating equipment at present is about 150,000 cycles. For higher frequencies above 100 kilocycles, vacuum tube oscillators, and spark gap



HEAT TREATING machine for induction hardening of internal diameters.

converters have been used. The application of vacuum tube oscillators for this service is now being developed. Research is opening up new fields in which large blocks of energy at frequencies which can only be supplied by electronic devices must be used.

Practically all rotating generators for this application are of the inductor type. This design differs from the conventional pole excited type in two important features. The first is the absence of windings on the rotor. This is



VACUUM TUBE power supply unit for providing 50 kw. at 125,000 cycles for high frequency induction processes.

an excellent thing from the maintenance standpoint, since the high speed drive at 1800 and 3600 rpm., makes it difficult to brace the windings and keep the insulation intact.

The second is the unique arrangement of the magnetic circuit. The stator is slotted for the armature windings, the rotor is also slotted, so that a given stator tooth will be opposed alternately by a rotor tooth and a rotor slot. The excitation is supplied by a single circular field coil surrounding the frame of the machine. As the rotor turns, when a rotor tooth is exactly below a stator tooth, the reluctance is a maximum and vice versa. This varying reluctance produces flux pulsations that induce in the stator windings a.c. voltages of a frequency depending on the speed, and the number of teeth in the stator and the rotor.

Maintenance engineers will find that high frequency MG sets of the open type will give less trouble, and operate with less temperature rise, if they are purposely provided with an adequate supply of ventilating air which has been cleaned. Some of these sets are of the air cooled type while others are air cooled and have water cooled stators. Sets that are completely dependent on air require more attention to this point because air gaps are small on this type

[Continued on Page 50]



# NEW Cable Lines..

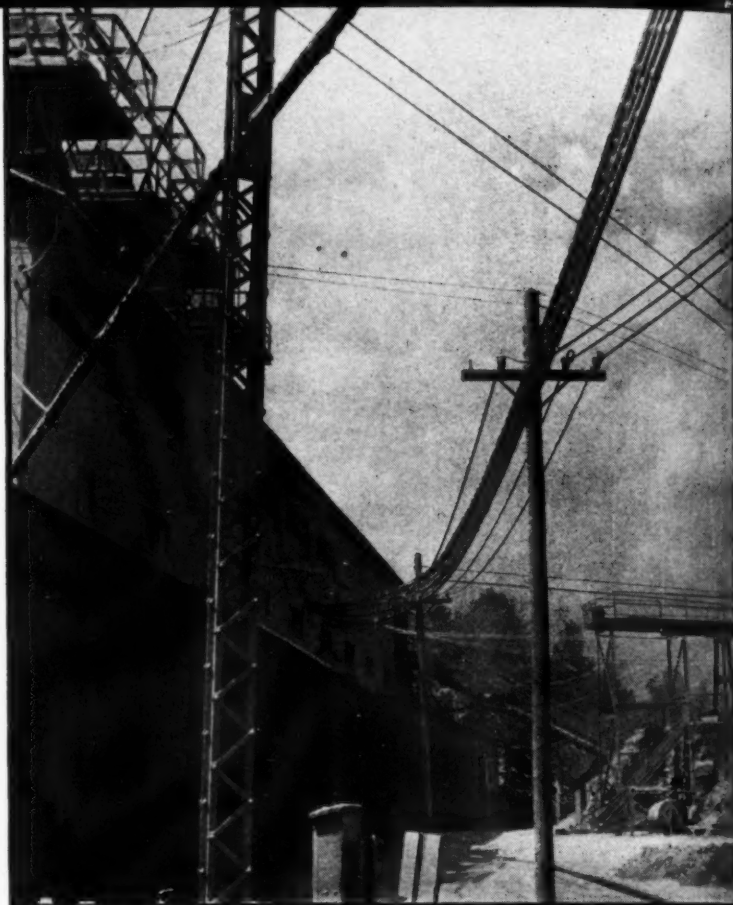
Armored, varnished cambric insulated cables replacing open lines reduces voltage loss in long 480-volt feeder

By G. L. Hoddy

General Electric Co.,

Thomas McDonald

Louisville Cement Co.



INTERLOCKED ARMOR cable feeder circuits from power house to plant is suspended by messenger wires from pole line.

**R**EVAMPING a transmission line at the Louisville Cement Company plant at Speed, Indiana reduced the voltage drop on a 460-volt circuit from 180 volts to 47 volts.

The company had originally built a 1150 foot transmission line from its power house to one of its mill units with an approximate capacity of 1500 amperes or 1140 kva. This consisted of 1000 feet of two 700,000 cm circuit conduit line. Power was generated at 480 volts, 3 phase, 60 cycles and about 20 per cent used at this mill unit.

The mill load consists almost entirely of induction motors which more normally divided into two operating units; preliminary process and tube mill. By

1939 the preliminary process had a connected load of 596 hp. and the tube mill 910 hp. The latter included four 150 hp., 600 rpm., induction motors.

The process was such that it was only necessary to run one operating unit at a time. With the maximum load under these conditions the voltage would sometimes dip to 390 volts.

In 1939 the expanded building program in this country made new demands on the cement industry. A change in the production process at this mill made it possible to run the preliminary process and the tube mill continuously at the same time to meet these new demands. The transmission line appeared to be the bottleneck.

With 700 hp. connected the voltage at the mill end dropped from 480 to 420 volts. As the four 150 hp. tube mill motors were started, the voltage dropped successively to 408, 382, 328 and 300 volts. A small additional load dropped the voltage to 240 volts and the motors pulled out.

At 300 volts the power plant meters on this circuit showed a load of 1050 kw., 2420 amperes and 2010 kva. The load at the mill end was 891 kw. at 71 per cent power factor. The difference was due to line losses.

It was necessary to determine quickly the best remedy that could be applied at reasonable cost. It was obvious that one of the following expedients or some combination of them must be used.

1. Reduce the reactive current by power factor correction.
2. Neutralize circuit reactance by series capacitors.

3. Improve voltage by using a higher transmission voltage or with induction or step regulators.

4. Reduce circuit impedance by rearrangement of the conductors, or by adding more parallel lines.

The different methods were analyzed from the standpoint of cost, time to secure apparatus and overall operating economies. Our calculation indicated that the desired results could be obtained at about the same cost for several methods, but it appeared that re-

## TABULATION OF READINGS TAKEN FOR THE THREE LINES.

	Former Circuit	With 3-500 MCM Cables	Final Circuit
Copper Size	1400 MCM	1500 MCM	2000 MCM
Capacitors	none	none	360 KVA
Mill load—kw	891	840	1000
" " power factor	71	71	83
" " volts	300	433	449
Power plant—kw	1050	900	1045
" " —power factor	52	71	83
" " —kva	2020	1270	1260
" " —volts	480	480	480
Voltage drop	180	47	31
Line copper loss—kw	159	60	45
Line reactive loss—kvar.	840	70	53

# .. IMPROVE VOLTAGE

placing the pole line with three 500,000 cm interlocking armor varnished cambric 3-conductor cables could be accomplished in the shortest time, and would offer opportunity for further expansion most easily.

Because of the reduced spacing of the conductors in this 3-conductor cable the circuit reactance was reduced 80 per cent.

After the new lines were installed the mill load was connected. The mill voltage was 433 volts with 840 kv. at 71 per cent power factor at the mill. The power plant meter showed 900 kw. on this circuit and 1260 kva. This amounted to a decrease of 74 per cent in the voltage drop at the mill and a reduction of 750 kva. load on the power plant. The copper loss in the lines was reduced from 159 and 60 kw. This was a saving of 99 kilowatt hours per hour.

Later it was found that the production process could be improved by the addition of air separation equipment to the mill load which would require an addition of 280 hp. in motors. In order to handle the additional load it was necessary to install another 500,000 cm. 3-conductor cable, and to add 360 kva. in shunt capacitors to reduce the load current. The capacitors were purchased in four 90 kva. units and each unit per-

manently connected to each of the four 150 hp. motors so that they would be automatically switched with load.

After these changes were made load readings were again taken and with 1000 kw. at 83 per cent power factor on the mill a voltage drop of 31 volts was recorded on the transmission line. The power plant meters on this circuit showed 1045 kw. and 1260 kva.

A new route was selected for the cable line in order to make room for future possible plant expansion. This allowed the old line to be continued in service until the new installation was complete and afforded better protection and support. The finished length of the new line is 1085 feet, 65 feet shorter than the old line. Maximum advantage was taken of existing buildings and structures for supports.

Each cable was supported, for its entire span length, on a ½-in. 7 strand, galvanized messenger. Galvanized cable rings were spaced about 24 inches apart. Each cable was spliced about midway in the run at a point where the cables pass through a building. The splices were enclosed in sheet metal junction boxes. This made the task of splicing easy and provides a convenient method of testing. Connections were made at each end of the line by stripping back the armor, taping the ends

and using standard terminals on each conductor.

The cost of the installation was as follows:

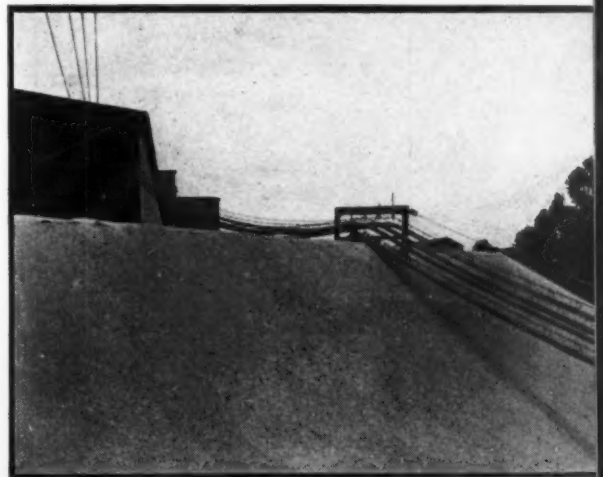
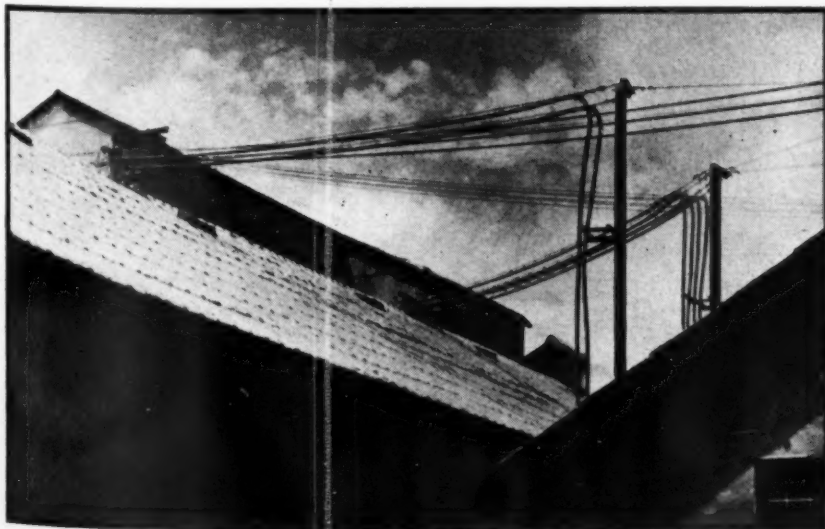
4360 ft. of 500,000 cm 3-con-	
ductor armored cable.....	\$8,899
4-90 kva. capacitor units.....	2,766
Messenger wire miscellaneous	
hardware .....	850
Labor .....	1,900

**Total .....** \$14,415

While stress on critical materials was not foremost at the time of this change, it is important to note that all of the advantages were obtained with relatively little additional copper, after credit was allowed for the salvaged copper.

The outstanding advantage of this installation of the Louisville Cement Company were as follows:

1. The ability to operate a 1000 kw. load with a voltage drop of 6.5 per cent compared to a 16 per cent voltage drop with the former 750 kw. load.
2. A direct saving of 114 kw. in copper line loss.
3. The removal of 800 reactive kva. from the generators.
4. Reduction of 60 to 100 amperes in lines to each slip ring motor.
5. With the present load it is expected that the installation will be paid for in direct savings, within four years.



*SUPPORT at the building ridge carries the cables diagonally clear of the roof.*

*RISERS from power house are supported on steel brackets up the steel column poles and hang from messengers on the horizontal run.*

# Supplementary Lighting Methods

## Twelve suggestions on specialized lighting applications for industrial conversion jobs

**W**HILE certain arbitrary standards of general illumination can be set up, they embrace general conditions only. Beyond this, seeing tasks of all degrees of severity are encountered in industrial work which dictate specialized lighting—lighting which is tailored to the job.

Supplementary lighting may be provided by units built into machines—by units of large area and low brightness—by concentrating type reflectors or the projector lamp located at a distance from the machine, and so placed as to build up the illumination over the area

where the severity of the visual task dictates plenty of light. Where the last method of mounting is employed, the source is out of reach of the operator and its position, after the initial adjustment, cannot be easily changed.

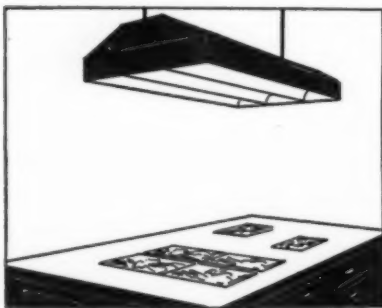
Where supplementary lighting is used, care must always be taken to avoid uncomfortable contrasts between the well-lighted work area and surrounding area, by providing a sufficient amount of general illumination of the proper quality. Under average conditions, a ratio of 10 to 1 in foot-candles is generally satisfactory. This means

that for every 100 foot-candles of supplementary lighting provided, there should be at least 10 foot-candles of general lighting.

The design and installation of the combination systems must not only provide a sufficient amount of light but also must provide the proper direction of light, diffusion, eye protection, and insofar as possible, eliminate direct and reflected glare as well as objectionable shadows. The following sketches, with comments, suggest practical lighting solutions for some of the more difficult seeing tasks found in industry.

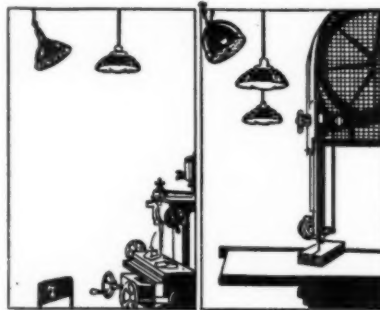
### 1. Commercial Color Correcting Equipment

For color work north skylight and noon sunlight equipments have long been available. With the daylight fluorescent lamps, high levels of lighting of daylight quality (6500° K) can be provided with no discomfort from radiant heat. The sketch shows a unit equipped with three daylight fluorescent lamps, mounted 3 feet above the task, and producing a minimum of 100 foot-candles over a relatively large area.



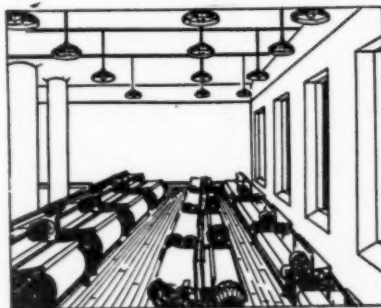
### 2. Concentrated Beam Sources

Industrial spotlights will provide high illumination over restricted areas where critical seeing requires from 50 to 250 foot-candles. This is encountered in thousands of applications in the machine tool, woodworking, printing, textile industries. When properly louvered and positioned, such units will provide glare-free lighting. Care must also be exercised in their location so that confusing shadows are not introduced.



### 3. Semi-Concentrating Equipment

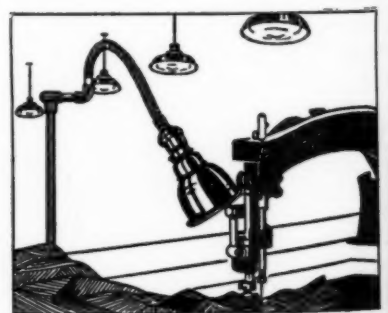
This type of equipment has a very high utilization over an area approximately 5 feet in diameter, when located 9½ feet above the work. It is designed for locations, such as over small looms, where a relatively high level of lighting is desired over an area of appreciable size. Equipped with a 200-watt lamp, approximately 50 foot-candles are provided, while at the same time sufficient spill light is obtained to illuminate satisfactorily the spaces between the main working areas.



### 4. Adjustable Local Lighting

Deep bowl porcelain enameled or aluminum reflectors, with substantial supports, holders and adjustment features, are suitable for intimate individualized purposes such as sewing machines, linotype. Half-shade reflectors even though adjusted to the satisfaction of the operators, are likely to be glaring to others.

Lamps of 25 to 60-watts will provide 50 to 150 foot-candles at a distance of 6 inches.




### 5. Luminous Panels

Open weave fabrics and translucent materials, such as glass, paper, plastics, and liquids, will often reveal certain kinds of faults and defects by transmitted light. Large luminous panels may be built in conveyor lines over which the material flows, or special inspection units, may be employed. While the illumination requirements may vary

[Continued on Page 47]

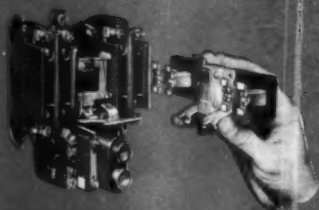




MISTER,  
we keep 'em *Clean!*

Keeping things shipshape is an unending job in the navy . . . for dust settles on horizontal surfaces everywhere whether these surfaces are parts of a boat far at sea or parts inside motor control in any factory.

Because dust is found in even the most unexpected places, it is not surprising to find it inside Motor Control equipment in any busy factory. Cutler-Hammer engineers recognized this . . . and they also knew that dusty, dirty contacts meant trouble . . . so they designed their famous VERTICAL contact Motor Control. Vertical contacts simply can't collect dust and dirt. They stay clean to work better and last longer. Such Motor Control that needs less attention and sets records for dependable performance in these days and nights of continuous high-speed production contributes not only to industrial efficiency but directly to national security. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee, Wisconsin. Associate: Canadian Cutler-Hammer, Ltd., Toronto.



*Dust Safe VERTICAL Contacts*

Cutler-Hammer Vertical Contacts are the mark of better Motor Control, another extra dividend on Cutler-Hammer's unequalled specialized experience and decades of Motor Control leadership.

1892-1942

50th ANNIVERSARY

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# When you plan war jobs make the most of these **FLEUR-O-LIER** advantages

## **BUILT TO DEFINITE STANDARDS**

These fluorescent lighting fixtures—FLEUR-O-LIERS—are built to 50 definite standards, set up by MAZDA Lamp makers, to protect users—assure satisfactory service and maximum light from their lamps. They're made by over 40 leading fixture manufacturers.

**TESTED!** Independent experts—Electrical Testing Laboratories of New York—put random samples of every size and design through exacting tests—determining their fitness to withstand tough, day-and-night war plant use.

**CERTIFIED!** All fixtures meeting these tests are so Certified by Electrical Testing Laboratories—and thus win the right to wear the FLEUR-O-LIER Label of Certification. This means not only certification of fixture assembly but also of every component part, including auxiliary equipment, ballasts and starters.

**GUARANTEED!** All FLEUR-O-LIERS carry the Fleur-O-Lier Manufacturers' 90-day guarantee. Every step in the production of a FLEUR-O-LIER fixture is added protection for you and the war plant you help to light.





## For war plants... large or small... FLEUR-O-LIER dependability counts!

- **Certified starters and ballasts**... assuring balanced operation—high power factor.
- **Durability and safety**... electrically and structurally sound.
- **Ease of maintenance**... easy to clean and re-lamp.
- **Maximum light output**... Certified control equipment plus high reflection factor assures efficient light from the lamps.
- **Flicker correction**... on circuits of two lamps or more.
- **Correct ventilation**... no danger of overheating in control unit.
- Every unit carries the FLEUR-O-LIER Manufacturers' Guarantee.

A vital tool in wartime production, fluorescent fixtures now require a suitable WPB priority rating. Any FLEUR-O-LIER Manufacturer will be glad to work with you on this to get the best lighting possible. FLEUR-O-LIER Manufacturers, 2122-10 Keith Bldg., Cleveland, Ohio.

# FLEUR·O·LIERS

## CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements.



# Editorials

## Building Price Ceiling Ahead

At long last there appears to be a special price regulation written to fit the methods of the electrical contractor on the way. It will probably be called Construction and Maintenance Services and will provide a ceiling price formula adaptable to the estimating, bidding and billing practices of the industry.

In the meanwhile, electrical contractors are subject to the provisions of the General Maximum Price Regulation and some, depending upon local interpretations, are abiding by Maximum price regulation No. 136.

When the new regulations are announced officially they will supersede the former rules and straighten out the complicated interpretation problems introduced by the inclusion of many types of electrical wiring materials, devices and equipment under the Machinery and Machinery Parts regulation.

It is sincerely hoped that the forthcoming rules will prove to be practical in application and reasonably equitable. In all probability they will be.

## Bare-Bones Wiring

Donald Nelson's request that, for the duration, construction of new facilities be "of the cheapest temporary character" for its contemplated war use is a direct challenge to all of us. The maximum economy of materials and manpower is indicated. It means bare-bones wiring.

But the practical application of the policy in electrical work leaves us just a little appalled. Counting out some of the more elaborate installations of

the war era, it becomes evident that the bare-bones policy is nothing new in this industry. We have been installing bare-bones jobs for a long time. Not, perhaps, as thin as intensive ingenuity can make them, but certainly close to the level of minimum essentials.

For the duration we must devote our energies to wiring with the least possible use of critical materials consistent with the greatest contribution to the war effort. We may find that this principle results in jobs not significantly different from all too common normal practice. Early replacement of these jobs and an effort to lift the industry as a whole away from the use of minimum requirements as a working standard ought to be one of our No. 1 post-war projects.

## Scrap or Metal Recovery

Probably no single wartime production problem hits so many business men and householders as the nationwide job of rounding up scrap metal and rubber. Our first efforts were desultory. We thought of "scrap" as "junk", totally worthless accumulations in our shops and homes that could be moved out with beneficial results to our establishments as well as providing a useful gesture to the war effort.

But scrap means more than this. Scrap metal is a basic ingredient for new metals. Anything that can be melted or remolded is scrap and that's the way we have got to start thinking about it. Scrap is any metal, regardless of what its value once was, that we can't use in its present form to help war production.

That is a drastic definition, but any-

thing less vigorous will round up little more than a patriotic but inadequate stack of discarded odds and ends, too little and too late. It is a hard definition because it gives us the responsibility for turning in materials that might some day have real market value in their present form. It is hard because it points out things which cost us money but which we know have no real usefulness.

It is no hardship to toss in a broken and rusted steam radiator, but how about the shining set of chromium plated bumpers on our cars? That hurts. Yet, in view of the desperate scrap metals need, those bumpers belong in the pile.

The same is true of a lot of miscellaneous hardware in the shop and home. If it isn't doing an important job, scrap it now.

The whole scrap program ought to be called a voluntary metal requisition to take the emphasis off the discarded lawnmower idea. This scrap collection job has only begun.

## Fuse Rules Check Distribution

Limitation Order L-161, prohibiting the use of copper for other than current carrying parts of fuses also limits their sale to A-10 or high preference ratings. While this ruling looks like an invitation to civilian disaster, in practice it acts only to provide a check on distribution.

Sales from the manufacturers to the distributor, wholesaler, contractor or direct to the customer are restricted to A-10 or high purchase orders. However, wholesalers, operating under PD-1X have the necessary rating and may sell fuses to their customers without a rating. In this way adequate supplies will be made available to civilian users without priority.

## We Can't Go Stale

An enterprising middle west electrical contractor recently told his association members how he reads and digests the technical literature that he receives. Unlike many who "get to it if they have time" he makes a point to carefully study all information that he receives—and this means underscoring all important details and para-

graphs. Then he files the literature for quick reference.

When a job comes along that involves any of the subjects, he packs along his marked literature on that particular subject and uses it to prove his points. He recently won two sizable contracts by bringing up ideas that were entirely new to the customer—and backed them up by underscored literature by recognized authorities in the field. This contractor makes his reading pay dividends.

We can't afford to go stale. We've got to keep up with developments. There'll be troublesome times ahead and it'll be the boys who are in there pitching with new ideas, latest methods and strategic material substitutions that will come out on top. This fellow seems to have one of the answers.

## Regrouping "Methods"

On page 36 of this issue we are starting a new department called "Methods". It consolidates material formerly arranged under other department titles, bringing together in one section more short articles geared directly to the every-day methods of our readers.

The new layout, besides providing a greater quantity of practical, how-to-do-it items, will permit the use of larger illustrations where the subject warrants, especially working drawings and diagrams. For the quick reader, a convenient tag line at the right following the title denotes the field of activity to which the article applies.

As in all of our departments, articles contributed by the readers of *Electrical Contracting* are cordially welcomed and paid for, on publication, at our regular rates.

We hope that you will find this new treatment of practical methods more accessible, more interesting and more useful than ever.

## It's An Engineer's War

General Henry P. Seidemann of the Army Specialist Corps gave the delegates to the NECA annual convention an insight into the tremendous demands for engineering skill in this war. Practically every piece of modern military equipment involves more

or less electrical apparatus and the skilled hands and brains to use this complex equipment.

It isn't so surprising in the light of electrical development since the last war, that electrical men must play an exceptionally prominent role in this. It is appalling though, to note the tremendous strides in electrical design since the war started. Look at the record since September 1939; low reactance distribution systems, infrared heating and drying, induction melting and hardening, industrial fluorescent lighting, load center distribution at primary voltages, these are only a few developments of major, even revolutionary proportions that have grown up in these brief months.

So even back at the production front it is an engineer's war, even if we may boast a little, an electrical engineer's war. From the building at the plant to the finally military machine, the progress of our industry has contributed to the job.

## It's Big Business

Most of the larger industrial electrical contractors in this country are busy on jobs of such high ranking priority that they are almost unaware of materials limitations. Many of them, unfortunately, are also too busy to realize the vital importance of guarding their business flanks.

However seriously we may individually cuss the vicissitudes of our business calling, the facts are that electrical construction is big business and growing bigger. When it comes to downright efficiency, ability and job management skill, the specialized contractor can always produce. But when the time comes to throw his weight around in unison with his fellows to develop and protect his markets, he is as often as not indifferent to this opportunity.

The problems of some splendidly equipped and staffed commercial electrical contractors straightened by war limitation is a case in point. Every one of them could be absorbed intact into joint ventures with other overburdened contractors on important war work. It is easier, however, to absorb them piecemeal. So we see their doors close and note their new addresses as employees of another contractor. Their particular skill is put to work, but their industry and

community standing as a going business is casually tossed aside as something of little worth.

If electrical contractors are unwilling to recognize that business organizations working as experienced and coordinated units are essential to competent electrical construction, can we expect others to do so?

## Back Talk

### Code Complications

To the Editor—"Your editorial, 'Distinguished Service', makes the point that the National Electrical Code is poor competition for Ellery Queen. Ellery Queen writes mystery stories. 'Mystery' means full of mystery, obscure. 'Obscure' means not easily understood, not much known, to perplex. In my opinion the Code makers do a first class job under this definition.

"Quoting a letter from my files from one of these Code makers, 'The code decisions are not based on engineering grounds, but on other reason'. If we knew the background for the decisions of the Electrical Committee which take form as an 'Official Interpretation' or as an 'Interim Amendment' they could be more readily understood by the people who must use them. For example, I have discussed Amendment No. 66 with a prominent inspector. He does not know how to apply this ruling, for many reasons which should be apparent to anyone engaged in electrical construction. The same probably exists with respect to Interpretation No. 216. By what yard stick does an inspector determine what is 'continuous operation'?

"Let's make these rulings understandable and applicable."

William J. Quinlan,  
Rochester, N. Y.

In the forty years that our industry has been guided by the Code, there has never been a time when we could say "this is a final job". A handful of men with all the known facts before them write a rule. It goes out to the thousands who must use it. The bugs show up. Discussion brings it back for amendment. And so the Code evolves, from year to year.

The puncture proof, universally applicable, completely infallible Code in which each rule can be substantially and accurately erected upon soulless mathematics, chemical formulae and physical equations is unlikely in our time. Now is it especially desirable. The border between "safe" and "unsafe" is a broad area of varying width. Someone must exercise the judgment necessary to draw the practical line. So we have the Code and the Electrical Committee.

In these times we must shift that line over nearer the "unsafe" than the "safe" side of our guard strip. This is going to take better design, more competent installation and more critical inspection. It certainly gives us all a greater personal and industry responsibility.

If we must compromise temporarily with our recognized margin of safety, the "Duration Amendment" is the safest way. Ohms law cannot be amended but our judgment of its effects can be tempered to the urgency of the moment. Questions of accessibility, continuous operation and the like can be left to local judgment. Rules insuring permanence can be suspended. But it must be kept in mind that the temporary rules adopted when human life and property are in far greater danger from other hazards than border-line wiring are not suitable for normal times whatever precedent or record is established under them.

Let us by all means make the Code more understandable and applicable. But the real problems encountered in the installation and application of electric wiring and equipment are neither simple nor universal. And improvement will come when many more men in the electrical construction field, who have the daily job of living under the Code, take a more active part in the discussion and preparation of the rules.

# Methods

**BRIEF ARTICLES** about practical methods of installing and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

## SKINNING DEVICE FOR RUBBER CORDS

WIRING

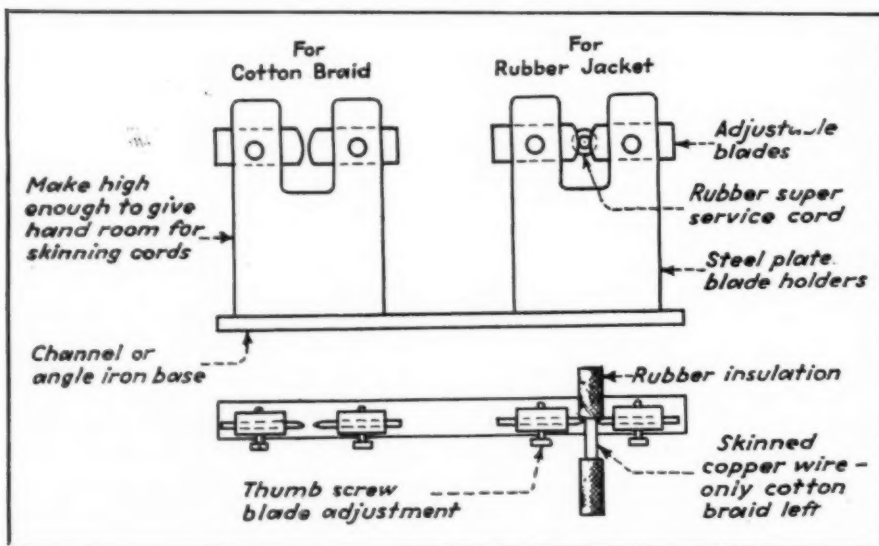
The John Miller Co., Detroit electrical contractors, has a knack of devising gadgets that speed electrical construction work. The fact that there were some 75,000 to 80,000 rubber covered drop cords to be skinned at both ends for the fluorescent lighting fixtures at the Ford Bomber Plant, didn't faze them one bit. Out came a gadget to solve the problem.

The double-barreled skinning device they designed, consists of two blade holders mounted side-by-side on a channel iron base. The blade holder is made of steel plates with a "U" portion cut out of the upper half. Adjustable steel blades with sharpened ends are fed from the outer edges of the holders and meet at the center of the "cut-out." The blades are adjustable horizontally for different sizes of rub-

ber cords and for different functions—removing the rubber jacket or only the cotton insulation on the conductors. Each blade is held in position by a thumb-screw.

The operation is simple. For removing the rubber jackets on the cords, the blades are so adjusted that they will cut only the rubber. The cord is forced through the blade cutting edges with a downward twisting motion, cutting the jacket around its periphery. A yank on the cord, using the blades now as a vise, will remove the jacket. The jacketless end of the cord is shifted to the second set of blades which are adjusted to remove the cotton covering of each conductor. The same type of twist and pull motion is used here. The blade adjustment is made so the copper conductors will not be damaged.

The John Miller Co. put cord skinning on a mass production basis at the Ford Plant delegating one man to do nothing but this operation, using the above described device.



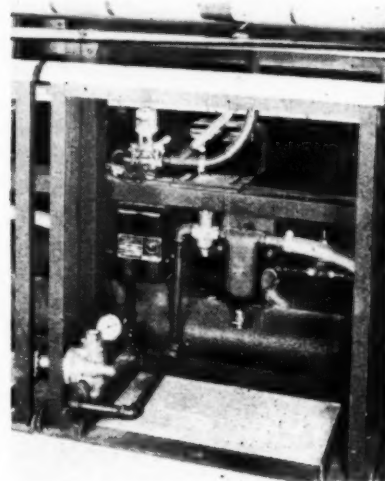
**DOUBLE BARRELED ACTION** of this cord skinning device simplifies this arduous task and places it on a mass production scale. Blades on right are for removing overall rubber jacket; those on left for individual conductor insulation.

## PHOTOELECTRIC CONTROLLED AIR DOFFER

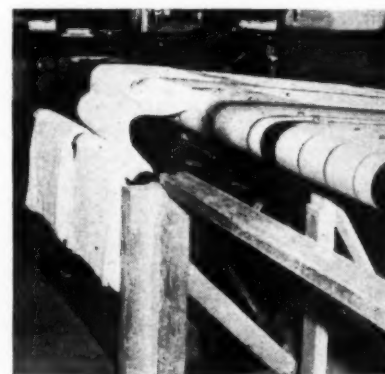
INDUSTRIAL

The Danvers Bleachery, Peabody, Mass., handles textile and laundry materials from conveyor to stack pile by means of compressed air and device embodying a photoelectric control.

With the machine in operation, pillow cases come through a large ironer



**ORDINARILY** a small percentage of the cost of a machine is represented in control equipment. In this case practically 100 per cent of the machine is control, with exception of the framework in which it is mounted, a regulating valve, air tank, and some piping.



**MACHINE** in operation with pillow cases being "floated" to the receiving rack.

onto a conveyor belt. The leading edge of the case on the conveyor interrupts a light beam and resets the mechanism for an operation. When the pillow case is beyond the light beam it allows the light to strike a phototube which opens a solenoid valve for a fraction of a second. This time is controlled by a vacuum tube timer. As the solenoid valve opens, air at approximately 15 lb. pressure is allowed to enter two horizontal perforated tubes. One tube blows air against the leading edge of the pillow case while the second tube blows air towards the lagging edge, passing it to the receiving rack.



## ESTIMATING GUIDES

### —Completing the Estimate —Special Systems—Job Costs

After having covered the gamut of estimating take-off and pricing we come to the final step of completing the estimate—taking care of miscellaneous job costs and making a recapitulation to arrive at the final bid price. This final phase will be discussed in this the eighth and last item of the "Estimating Guides" series based upon suggestions outlined by the Electrical Contractors Association of the City of Chicago.

Before going into detail on job costs and the final check-up it might be well to consider briefly any special systems that might occur in the plans and specifications.

**SPECIAL SYSTEMS**—Special systems may be part of the job to be figured. Any such system should be figured separately and handled in a manner similar to that described for other branches.

The following might be considered as special systems:

1. Signal and alarm systems.
2. Public address systems.
3. Intercommunicating telephones.
4. Night watchman systems.
5. Protective lighting.
6. Centralized control for lighting (for blackouts).
7. High cycle systems.
8. Direct current systems (in a.c. plants or vice versa).
9. Electric clock and time control systems.
10. Other systems that are not specifically straight standard power and lighting systems.

**JOB COSTS**—For sizable jobs it is important to make up a job cost sheet covering tools and other unidentified job cost items. This sheet should include:

1. Tools
2. Scaffolding, ropes, etc.
3. Freight and cartage
4. Job office and shops
5. Travel expense
6. Engineering and drafting
7. Testing
8. Storeroom attendant, and time-keeper
9. Telephone
10. Light and power

**SUMMING UP**—Now that we have taken care of all phases of the estimate, including the miscellaneous job costs, we are about ready to make a summary of the entire estimate. Before doing that, however:

1. Be sure all items in the specifications and plans have been checked off.

2. Check all notes shown on plans and specifications and those you have jotted down.

After thoroughly checking the estimate, proceed to complete the estimate by doing the following:

1. Make up a summary sheet showing, in separate columns, material and labor for each division, including job costs.
2. To the final summary sheet totals add the following:
  - (a) Insurance
  - (b) Incidentals
  - (c) Inspection
  - (d) Bond
  - (e) Sales tax
  - (f) Overhead
  - (g) Profit

The estimate is now complete and ready for submission as a proposal. Keep the estimate filed for ready reference—it is a mighty important tool, once a job is awarded. It is a guide for ordering materials and an important guide of labor cost distribution.

In preparing estimates, there are four general rules that should be kept in mind.

1. Use good estimating forms.
2. Use good estimating tools.
3. Establish a uniform method of carrying on the work.
4. Keep accurate cost records of the job. Use these for checking and for future reference and use.

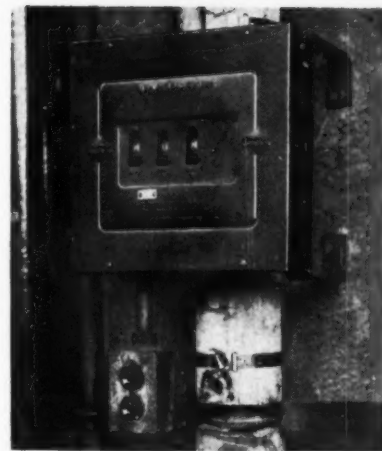
When making an estimate, remember it is better to lose a job because you are right—than to get it because you are wrong.

## TAMPER-PROOF LIGHTING CONTROL

INDUSTRIAL

At the roundhouse of an Eastern railroad company the main power feeders have been brought into a De-ion breaker panelboard and the circuit breakers taken from there. The De-ion panelboard arrangement eliminates the necessity of fuses and prevents tampering. At the main panelboard are four circuits used to control "night lights," which are the first rear lights in each stall and are kept lighted all night on account of the passageway around stalls.

The branch circuit switching for controlling the lights in each stall is located at the rear column and is also De-ion breaker controlled. Every other rear column has a group of three breakers and the intermediate ones have four. The group of three breakers is so wired that one breaker will turn on three lights on one side of the locomotive, a



TYPICAL MOUNTING of control switch box for lighting in railroad roundhouse.

second breaker will turn on three lights on the one side of the locomotive in the adjacent stall, and the third breaker will turn on two front lights which are focused to the floor. The group of four breakers operate the same except the fourth one is used to control a plug receptacle circuit for extension cords. The photograph shows the control switch box mounted on column.

With this mounting and switching arrangement any particular part of a locomotive on which men happen to be working, can be lighted which results in economical operation and low maintenance.

## DEAD END SWITCHING STRUCTURE

WIRING

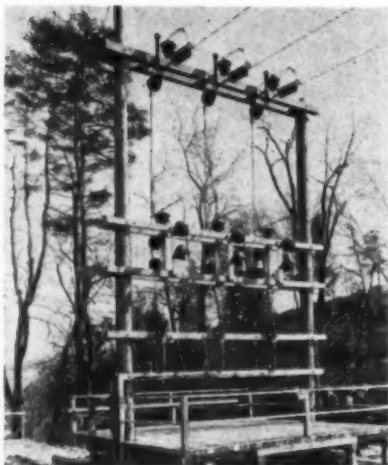
A two-pole switching structure made entirely of wood, dead-ends and provides primary protection to a 13,200 volt, 3-phase incoming power company line. This service feeds circuits that terminate at two outdoor load-center unit substations at an industrial plant.

The dead-end structure is built around two wood poles which support a series of double crossarms on which are mounted the insulators, bus work, disconnects and cable potheads. The equipment includes the dead-ending insulators, buses and distribution type lightning arrestors on the top arms. The middle set of cross pieces mount two sets of General Electric type EF-2 fuseholders with EG-1 disconnecting type fuses, mounted back to back.

These disconnect fuses feed two, 3-phase circuits through two sets of single-conductor potheads mounted to the lower crossarms. These cables enter two underground conduits at the wooden operating platform and emerge at the outdoor load-center unit substation

# Methods

[FROM PAGE 37]



**ALL WOOD SWITCHING STRUCTURE** dead-ends and protects 13.2 kv. incoming high line serving an industrial plant. Two primary 3-phase circuits leave the structure and go, in conduit, underground to two outdoor type load-center unit substations at the building.

where the low voltage current is distributed throughout the plant.

The long cylindrical container fastened to the platform guide rail, houses the disconnect switch hook.

## CAPACITORS CUT WIRING LOAD

INDUSTRIAL

It looked as though new wiring was a "must" at the Ferro Machine and Foundry Company, Cleveland, Ohio. Most of the plant load is made up of

220 volt, 3 phase induction motors driving air compressors, tumbling mills, and other foundry equipment. Load factor was 70 per cent and power factor was down around 67 per cent.

However, 600 kva. of Westinghouse dust-tight capacitors was connected in the system which brought power factor up to 97 per cent and cut the current on two overloaded feeders by 20 amps. Feeder capacity is now adequate throughout the plant.

Half of the 600 kva. is arranged in a switch house on the 2,300 volt side of the transformers. The rest is connected at the ends of the 220 volt feeders in banks of 45 and 90 kva. The use of dust-tight units is advantageous because they demand relatively infrequent inspection and cleaning.

## BUILDING AN ELEVATOR SCAFFOLD

WIRING

The problem of efficiently mounting heavy busway, weighing 900 lbs. per 10-ft. length, was quickly solved by Art Harmon of Harmon Electric Co., Chicago, a member of the joint venture group working at the aviation engine plant of the Buick Motor Division, General Motors Corp.

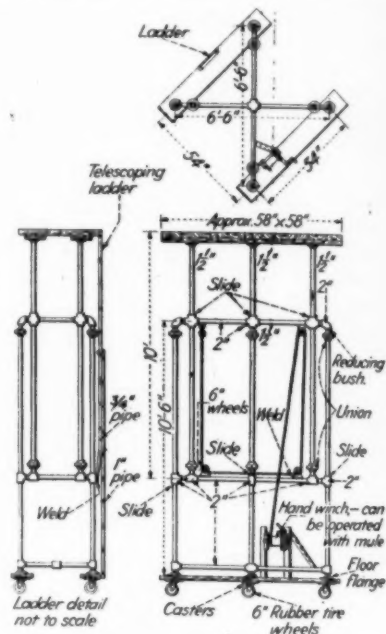
He gathered together an array of pipe ties, elbows, couplings, unions, some pulleys, wheels and a hand winch and designed and built a rolling elevator scaffold. Busway sections, hoisted on the scaffold platform could be raised into place and connected by mechanics working on the platform.

The stationary scaffold framework is 4-ft., 6-in. square; 10-ft. 6-in. high and is mounted on six 6-in. rubber tired wheels. The working platform can be

elevated to permit working at high mounting heights.

A hand winch and a  $\frac{3}{4}$ -in. steel cable are used to raise and lower the elevator platform. For exceptionally heavy loads, a power unit (Mule) can be attached to the lever-shaft of the winch.

A telescoping ladder arrangement, mounted to one side of the scaffold,



**CONSTRUCTION DETAILS** show how an efficient rolling elevator scaffold can be made from a few lengths of pipe, some fittings, a bit of steel cable and a small winch.

gives easy access to the platform.

By using several of these scaffolds and elevator trucks to hoist the equipment to the scaffold, the joint venture group was able to install heavy busways and other equipment on a mass production schedule.

## MOBILE EQUIPMENT

WIRING

Mobility is good for the army, and in the times ahead it is apt to be good for the contractor. Pacific Electrical & Mechanical Co., Inc., of San Francisco has been "mobilized" and is on war footing with a fleet of three shops on wheels and a pickup or "scout" car. This fleet is not its heavy construction contracting flotilla. Rather it is its repair, service, jobbing and emergency trouble shooting fleet, available on 24-hour a day basis as a particular branch of its business.

This specialty, which has been a year and a half in building up by Tom Bennett, manager of the electrical department, is a natural outgrowth of an organization affiliated with building main-



**MOST OF PLANT LOAD** is made up of 3-phase induction motors as this one illustrates. Right hand corner shows a bank of capacitors connected at end of feeder.



## WESCO'S help made bombs 68 days earlier

### WESCO SPEEDS PRODUCTION

- \* A Marine air base needed delivery of hundreds of electrical items next morning. Five Wesco Houses pooled stocks and met the deadline.
- \* Lack of a critical product threatened to tie-up a war chemical plant. The manufacturer promised delivery in 60 days. Wesco delivered in 24 hrs.!

### WESCO SERVES BUSINESS

- \* By warehousing stocks in anticipation of customers' needs.
- \* By providing engineering service in making up lists of materials and in preparing bids on jobs.
- \* By buying large quantities at low prices and passing the savings on to small-quantity buyers.

*The name that means  
everything in electricity*



### Electrical Items Delivered in Two Days — 92 Internal Records Eliminated

In Texas a new plant to make the base of a High Explosive was racing to completion. Its capacity was vitally needed to break the bottle-neck of ammunition shortage. Suddenly, lack of two electrical products pulled the job up short. Inquiries to manufacturers brought the disheartening reply—"Best delivery 8 to 15 weeks." This meant a complete tie-up.

The local Wesco House was called, combed its stocks and delivered the critical products in 2 days; the work went on and the job met the scheduled deadline. As a "dividend" Wesco cut the customer's office routine transactions from 126 down to 34. He was saved the time, work and paper involved in keeping 92 records which would have been required had he dealt with the manufacturers.

Today Wesco's abilities, services and stocks are "all out" to help America win the war. On V-day they will as wholeheartedly respond again to help American business win the peace.

# Westinghouse

**ELECTRIC SUPPLY CO.**

150 VARICK STREET • NEW YORK, N. Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 79 BRANCHES

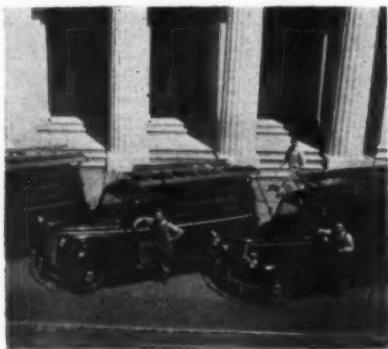


## Methods

[FROM PAGE 38]

tenance on a large jobbing scale. The same careful management of details to make building maintenance pay out is necessary in such an electrical maintenance department. It must be run so that it can take care of small jobs from one dollar up to remodeling of an entire building.

Each truck is completely equipped with materials enough for a week's work. It has all necessary tools. Travel and rubber can be conserved by having it so stocked, so can time, a high cost commodity. The men who operate these



**TRUCK FLEET** stocks supplies for week's work at outlying jobs with specially trained crews for expert and speedy service.

trucks have been especially picked and trained men, long with the company, expert trouble shooters, capable of getting on and off the job efficiently.

Fixture hanging on a quantity basis, maintenance work for gas and oil service stations, repairs and trouble shooting are the kind of work on which these trucks are used exclusively and the business along these lines, with new civilian construction on the shelf, is being developed as an important branch of this contracting business.

### GROUP DRIVE IN TRENCHES

INDUSTRIAL

When the knitting plant of Tubize Chatillon Corporation was built at Hopewell, Va., lineshafts and driving motors for group drive were installed in trenches cast in the concrete floor. In this way advantages of group drive were retained and disadvantages of overhead belting were eliminated.

Trouble caused by static electricity was an important reason for this un-

usual type of drive. Absence of overhead belting also improved plant illumination, making possible the use of high-intensity general lighting. In addition, belting costs have been reduced because of the short center distances between lineshafts and machines. Finally, maintenance costs have been considerably reduced because to get at one of the hangers for inspection it is merely necessary to lift up the belt guard and the trench cover.

### EXPANSION PULL BOX

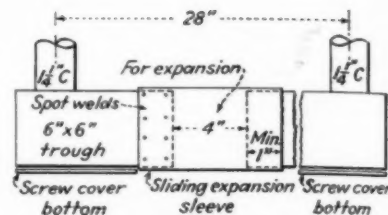
WIRING

The Associated Electric Construction Company, Melrose Park, Ill., joint venture group on a large defense plant job, designed and installed expansion pull boxes where conduit runs passed building expansion joints.

The pull box consisted of two 6-in. by 6-in., sheet steel sections that telescoped into a common sliding sleeve. One end of this sleeve was spot welded to the end of one of the pull box sections; the other end was free to slide over the other section and take care of a maximum of four inches expansion or contraction.

Conduits entered the top of the pull box sections, at right angles to the expansion joint. The bottom of these sections were removable screw covers which facilitated pulling-in the cable and forming sufficiently large loops to take care of any expansion in the building.

The same principle was used for straight-through conduit runs, with the size of the box depending upon the



**TELESCOPING PULL BOX** provides necessary area or looping cables, facilitates pulling cables and takes care of expansion and contraction at building expansion joints. Conduits can enter straight-through or at right angles.

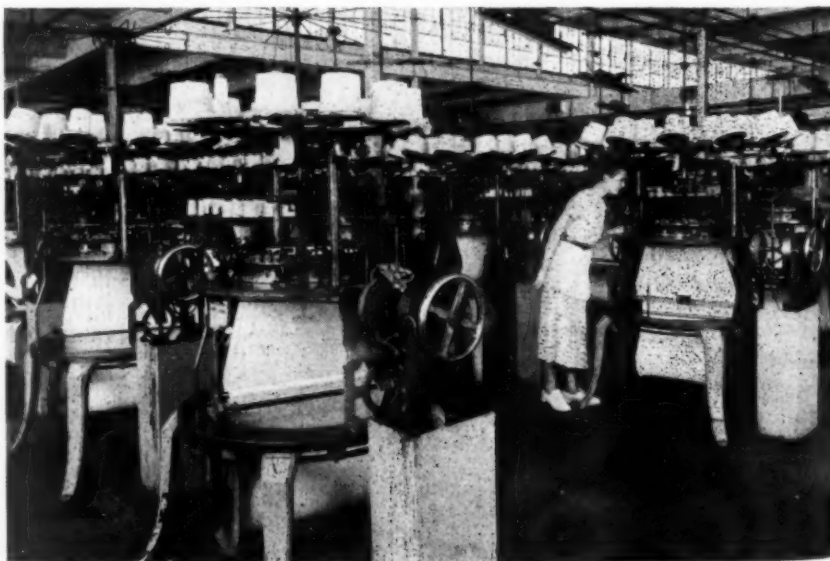
number and size of the conduits entering and leaving the pull box. Flexible jumpers preserve electrical continuity for the metallic grounding of the conduit system.

### LOAD CENTER CALCULATIONS

ESTIMATING

Many estimators are frequently called on to make electrical layouts before preparing an estimate on the cost of an electrical installation. This is particularly true today where, in many cases due to the rush to complete buildings and plants, only pertinent data on the electrical load is given. The rest is left to the contractor and his engineer or estimator.

Important in all electrical designs, is the proper location of the load center. Where, from the standpoint of good design and installation economics, should it be located? One of the best methods of determining load center location is by the "foot-ampere" method of calculation. By this method, the



**GOOD GENERAL ILLUMINATION**, elimination of belt static, low belt cost, and ease of maintenance result from placing the group drives in trenches below the floor.

THE HAND CAN BE NO SURER

THAN THE EYE

# Maybe it's easy for you to get Fluorescent!

**M**ANY war plants that stand to gain immeasurably by fluorescent lighting do not now have it—mainly because priority regulations scare them off.

As a matter of fact Uncle Sam's policy is that any plant engaged in important war work may install fluorescent lighting—simply upon proving that there is a genuine need for better lighting.

Thus, obtaining the official go-ahead is a lot easier than you think—especially since those in authority are well aware of the many advantages inherent in good lighting.

They know the importance of this cool, glare-free, shadowless lighting in promoting plant efficiency, in stepping up output, without additional copper wiring.

And they know that finer lighting means fewer accidents, better workmanship, better morale.

So contact every local firm producing for the war effort and needing improved lighting. Do your part in speeding war production by demonstrating how much fluorescent can help.

Naturally, you'll sell fluorescent at its finest—Sylvania (formerly "Hygrade") Lamps operating in Sylvania fixtures and with Sylvania accessories.

Since the pioneer days, Sylvania's advanced research has carried quality a long way forward. So today, Sylvania Lamps have five provable points of superiority: (1) They have visibly smoother coating. (2) They possess greater uniformity in light-color. (3) They remain "bright to the last inch"; early end-darkening doesn't impair their efficiency. (4) They give more light—more lumens per watt. (5) They last longer.

Our representative will gladly assist you in securing the necessary priority rating.

## **SYLVANIA** ELECTRIC PRODUCTS INC.

*Formerly Hygrade Sylvania Corporation*

**Salem, Mass.**

*Incandescent Lamps, Fluorescent Lamps and Fixtures, Radio Tubes, Electronic Devices*

# Methods

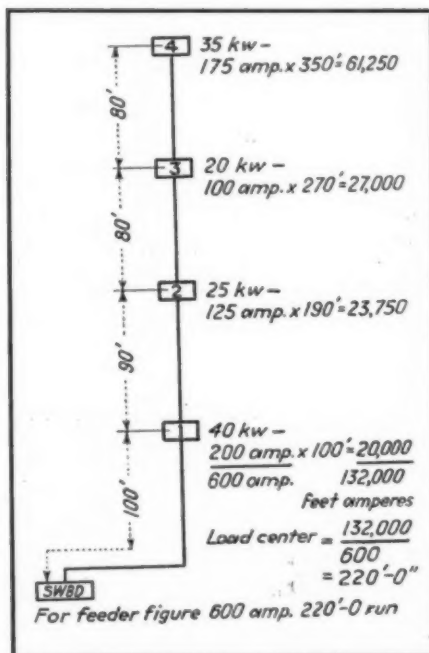
[FROM PAGE 40]

ampere load at each location is calculated and the distance of each load from the main switchboard determined. Each load (in amperes) is multiplied by the distance (in feet) of the load from the main switchboard to give "foot-amperes." Then the amperes and foot-amperes for all locations are totaled. By dividing the total foot-amperes by the total amperes the location of the load center is determined. The answer is given in feet from the main switchboard.

The accompanying chart was compiled by Ralph H. Decker, consulting electrical engineer, Chicago, to illustrate the method of computation. To understand the details more clearly, let's follow through the problem he has assumed and the solution he has given.

**PROBLEM:** There are four different electrical loads located at different distances from the main switchboard. A 40 kw. load is 100-ft. from the board; a 25 kw. load is 190-ft. from the board; a 20 kw. load is 270-ft. from the board; and a 35 kw. load is 350-ft. from the board. Where should the load center be located?

**DATA:** From the kw. loads we can determine the load amperes at each location. For the sake of sim-



**TYPICAL PROBLEM** showing the steps in the determination of load center locations by the "foot-ampere" method. Once this location is determined, feeder sizes can be calculated.



**CURTAINS OF CONDUITS** and control panels line the walls of one of the switchrooms at the Ford Bomber Plant. Each one of the thousands of control conduits are numbered at the panel to correspond with identifying circuit numbers on the plans and at the equipment. Numbers are stenciled on the inside of the panels. John Miller Co., Detroit was the electrical contractor on the project.

plicity we have assumed a single-phase, 3-wire lighting load at 100-200 volts (conventional voltage is 115-230). We know the distance of each load from the main board.

**SOLUTION:** By multiplying the calculated ampere load at each location by the distance from the main board we get "foot-amperes" for each location. By adding all the amperes and foot-amperes in separate columns we get total amperes and total foot-amperes. Dividing total foot-amperes by total amperes gives the load center location in feet from the main board. Putting this data given in the chart into tabular form we have:

Location No.	Load KW.	Load Amps.	Dist. from subd.-ft.	Feet Amperes Dist. x Amps.
1	40	200	100	20,000
2	25	125	190	23,750
3	20	100	270	27,000
4	35	175	350	61,250
Total		600		132,000

Then: Location of Load Center =  $\frac{\text{Total Feet-Amperes}}{\text{Total Amperes}} = \frac{132,000}{600} = 220 \text{ feet}$

Thus the load center to feed these four distribution points should be 220 feet from the main switchboard. The feeder to this load center should be capable of delivering 600 amperes at a point 220-ft. from the main switchboard.

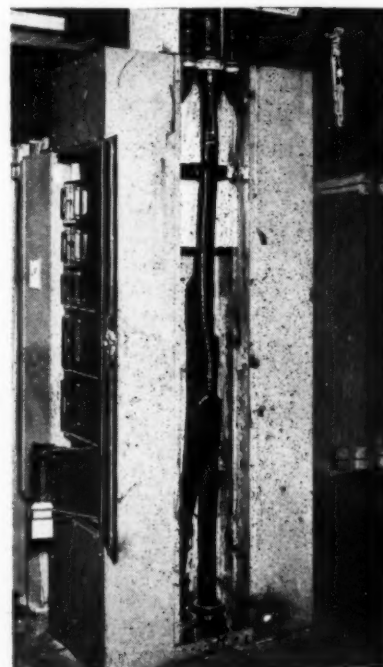
Calculating load centers by this method takes the "guess" out of estimating and makes it pure and simple estimating—a science that is vitally important. Furthermore, it brings engineering into the field of the estimator—a combination that is highly desirable in the electrical construction industry today. Data from Ralph H. Decker, Chicago, Ill.

## STEEL COLUMN USED AS PULL BOX

WIRING

At the Ford Bomber Plant the steel columns of the building structure were used, wherever possible, as pull and splice boxes for various electrical systems. This was particularly true where two panel cubicles were mounted back to back on opposite column flanges. The overlap of the cubicles plus the web of the beam formed a natural space for cable splices.

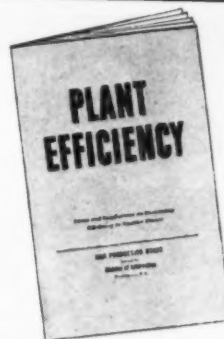
In many instances the practice was to



**AMPLE SPACE** for large splices or easy pulling is provided by this pull box formed by the web of a steel column and cubicle overhang. Method reduces steel consumption and saves time and labor.



# HAVE YOU SEEN THIS NEW BOOK PUBLISHED BY THE WAR PRODUCTION BOARD?



## GOOD LIGHTING—BETTER WORK

Good lighting sharpens the worker's most important faculty—sight. It is an effective means of increasing shop efficiency and maintaining production at a high level.

**1. Increased production.**—When light is good, an operator or inspector does not have to look long and fixedly, straining his eyes, to make out fine details or to detect minute flaws. The more light, the greater the speed and accuracy of seeing. The necessity for spending extra seconds to be sure of a reading or of a detail may not seem important. But if that process is repeated many times a day, the time lost runs into minutes. Greater ease in seeing means using up less nervous energy. It leaves more energy for productive work.

**2. Better workmanship.**—With good lighting, men can see what they are doing. There is no necessity for making guesses or taking chances, and less excuse for making avoidable mistakes. Since defects can be detected more readily, they are much more likely to be caught under good light before work has gone through all operations to final inspection. Hence, there is less wastage of time, effort, and materials.

**3. Continued production by older employees.**—Advancing years tend to dim the eyesight of older workers whose skill and knowledge are needed now as never before. When old-timers are provided with good lighting, tailored to individual needs, it is frequently possible for them to keep on doing the precision work for which they are fitted, instead of being assigned to other tasks where their training and experience are of little value.

**4. Less eyestrain.**—Older workers are not the only ones who profit by good lighting. The eyes of young workers, too, become fatigued and strained when they are required to perform tasks for which illumination is not adequate. Eye fatigue and strain are frequent causes of headaches and general discomfort. One large plant reports that the dispensary had a decrease of approximately 30 percent in calls for headache tablets following installation of a modern lighting system.

**5. Reduction in accidents.**—Striking examples of close relationship between the quality of lighting and accident frequency are not difficult to find. For example, when intensity of illumination in the punch press department of one company was raised from 1.5 foot-candles to 19 foot-candles at the working level, the frequency of minor accidents quickly dropped nearly 54 percent. In another plant, accidents decreased 11 percent after the old lighting system was replaced with a new one.

So many factors are involved in industrial accidents that it is practically impossible to say what percentage is caused by poor lighting alone. It is reasonable to assume, however, that, with the quicker perception and greater clarity of vision which good lighting makes possible, accident hazards will be recognized faster and more clearly, with correspondingly increased chances of avoiding them.

If you are doing any work in war plants, you ought to have a copy of this new 39-page booklet on Plant Efficiency, published by the War Production Board.

It covers such important production problems as, adapting old machines to new jobs, maintenance and repair, worker training, plant protection, getting into war work, etc. But what will chiefly interest you—and help you with your customers—is the fact that lighting is given a prominent place, because it is vitally important to precision work.

You can get a copy from your local WPB office. If they've run out, write War Production Board, Washington, D. C.

The General Electric Company, through our staff of lighting engineers, is glad to cooperate with you to help you provide better lighting to speed war production. General Electric Company, Nela Park, Cleveland, Ohio.

**G-E MAZDA LAMPS**  
**GENERAL ELECTRIC**

# LATROBE

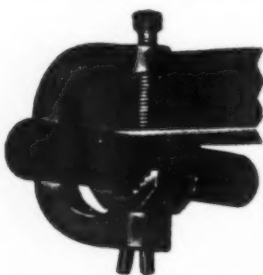


**"BULL DOG" INSULATOR SUPPORTS**

A wide variety of sizes for every requirement. Machining and threading carefully done for extra speed in installation.

## FLOOR BOXES and WIRING SPECIALTIES

Latrobe Products are serving with distinction in war production plants throughout the nation where maximum service must be obtained. Ease of installation saves time which in war emergency work is highly important. The "Latrobe" line includes approved types for all industrial, commercial and residential jobs.

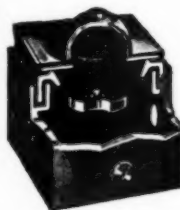


**No. 470 CONDUIT HANGER**

Pipe support turns freely, allowing pipe to run parallel or at right angles to beam. Does away with drilling or use of straps. Handles  $\frac{1}{2}$ ",  $\frac{3}{4}$ " and 1" pipe to steel beams  $\frac{3}{8}$ " thick.

**No. 251-R ADJUSTABLE GANG FLOOR BOX**

This box has flat sides to permit extra conduit holes if required. Cover plates are  $3\frac{1}{2}$ " square. Interchangeable with covers of 2, 3 or 4 gang boxes.



**No. 285 DOUBLE DUPLEX**

**RECEPTACLE NOZZLE**



The most attractive, compact, easy-to-install fitting on the market. Shown in the accompanying illustration with No. 200 Cover plate.

**KEYSTONE FISH WIRE**

Made of finest grade flat steel wire properly tempered. Ten sizes—for the lightest work up to the heaviest power wiring. Packed 100, 150 and 200 foot coils. Other lengths if required.



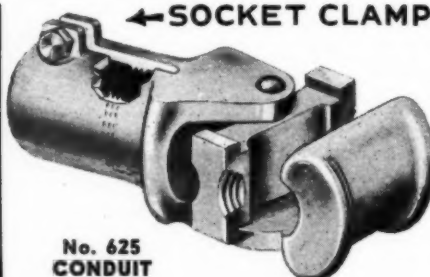
**No. 120 "LATROBE"**

**ADJUSTABLE WATERTIGHT FLOOR BOX**



No. 120 Box with No. 206 Stem Nozzle. Designed for telephone outlets or where permanent connections are made or as a junction box. Cover plate  $3\frac{1}{2}$ "—overall height  $3\frac{1}{2}$ ".

**← SOCKET CLAMP**



**No. 625 CONDUIT BENDER**



Check your stock today and let us know your requirements. We will make every effort to ship when wanted.

**FULLMAN MANUFACTURING CO.**  
LATROBE . . . PENNSYLVANIA

*Methods*

[FROM PAGE 42]

install a separate steel splice or pull box either in the web of the beam or bridging it. However, at the bomber plant, wherever this condition occurred, flanges were welded to the sides of the cubicles and a steel plate to bridge the cubicle overhang and close the top web of the beam was installed. This provided a deep, tall pull box which was enclosed by a removable screw cover.

Underfloor conduits entered the bottom of the box and were suitably grounded. Branch circuit and feeder conduits terminated at the top of the splice box. Cables and splices were carefully taped and tied to supporting brackets welded to the column web.

Not only did this method, approved by the local electrical inspection authorities, save considerable time and expense; but also reduced the use of steel—a vital problem in today's war-time construction. The John Miller Electric Co., Detroit, was the electrical contractor on the job.

## More Gossip

### Carmichael Heads Vancouver Group

At a recent meeting of the Vancouver Electrical Association, Vancouver, B. C., J. C. Carmichael of the Carmichael Electric, was elected president of the group. The vice-president is Charles Longley, Longley Electric, Ltd., secretary, J. S. Homersham, Homersham Electric; and treasurer, Robert Sutherland, Sutherland Electric.

Other members of the official body are: T. Barwood, Ideal Electric; R. Beaumont, Beaumont Electric & Radio; A. R. Crowe, A. R. Crowe Electric; R. Hall, B. C. Electric; B. Graham, Graham Electric Co., Ltd.; Sewell, Ricketts-Sewell Electric, Ltd., and G. G. Wallace, Wallace Electric, Ltd.

### New City Inspector

Earl Haskins has recently been appointed to the position of electrical inspector for the city of Galesburg, Illinois.

### Project Inspector

Former chief electrical inspector for the city of Houston, Texas, L. R. Bagwell, is now chief electrical inspector for Sheeve, Anderson and Walker on the Dickson Gun Plant at Houston.

## Let's Swap

"Let's swap," is a favorite greeting between members of the Cook County Electrical Contractors Association, Chicago, these days. To expedite electrical construction on essential war work they have revived the old barter system of the pioneer days. While waiting for a priority rating to come through, a contractor will trade some of his excess stock of equipment with another member for the type of material he needs to start the job. The trade is always of equal value.

The executive secretary, Herb Binner, acts as the clearing house. He keeps a file of excess stock of materials sent in by his members. These cards are filed according to material categories. When a call comes in, Herb consults his files and tells the inquirer who has the materials he requests. From there on, it's a swap between the two interested parties. So far the system has worked out well, and many a member has been able to speed up his work through barter of this type.

## Increase Service Department

The Wendell Electric Service has occupied its new store at 1357 Main St., Marinette, Wis. This new location features an increased service department for the repair of electrical appliances.

## Quinn Now Chief Inspector

Elmer Quinn, assistant chief electrical inspector, City of Newark, N. J., was recently appointed chief electrical inspector for that city, to fill the vacancy caused by the retirement of the late Ralph B. Ward. Mr. Quinn was in the employ of the City of Newark since December, 1919 and served in the inspection bureau until 1938, when he was made assistant chief inspector—the position he held until his recent advancement.

## Blackout Authority

Carl W. Zersen, director of the Chicago Lighting Institute is rapidly becoming an authority on "Blackouts". With the aid of his staff he has built an imposing display at the Institute. To top it all, Carl is being kept on the go, imparting his knowledge of the subject to various electrical industry and safety and protective groups.

## With Bureau of Standards

Andy Tait, who attended and spoke to numerous industry groups throughout the United States as field representative of the National Adequate Wiring Bureau, is now associated with the National Bureau of Standards, Department of Commerce, Washington, D. C.



*Here's Why*  
**GREENLEE  
BENDERS**  
*save 15% to 75%*  
**IN TIME AND LABOR COSTS**

As good man power becomes scarcer in the present emergency, increase the efficiency of your men by turning to a better use of tools. Let Greenlee Benders help you speed up construction by making the work easier and faster for the man on the job. Greenlee Benders are daily saving contractors from 15 to 75% in time and labor costs.

## EASIER AND FASTER

To make the job of bending conduit easier and faster, two sizes of hydraulic power units are used on Greenlee Benders. The No. 770 Power Unit, with a maximum piston pressure of 25 tons, has been designed for fast bending of small conduit up to 3-inch. The larger No. 775 Power Unit, with a maximum pressure of 40 tons, has the extra power needed to bend the larger conduit and pipe from 3 to 4½ inches.

## ONLY ONE MAN TO OPERATE

One man pumping the handle can easily develop the power required to make accurate bends in 1¼ to 4½-inch material without kinking or distortion.

## PORTABLE, EASY TO SET UP

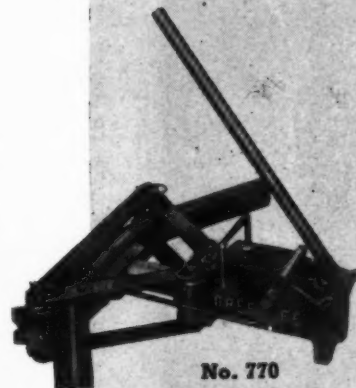
These light, portable Greenlee Benders are built compactly into one unit and are easily carried to the job and set up, and will not move or twist about when in use.

## BENDS RIGHT ON JOB

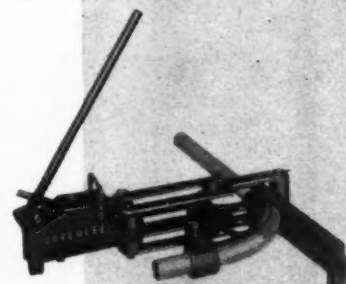
By bending right on the job you save the cost of many manufactured bends and fittings, and also the cost and time of cutting and threading nipples. Material is bent cold without filler.

## A BENDER FOR EVERY JOB

Whatever you have to bend... tubing, conduit, pipe, or bus-bars... there is a Greenlee Bender to do the job. Small hand benders will bend tubing from ¾ to 1½-inch, while Hydraulic benders are available for bending 1¼ to 4½-inch material. Write today for Bender Booklet S-116, describing the complete line of Greenlee Benders.



**No. 770  
Rigid Conduit  
and Pipe Bender**



**No. 770-T  
Thin-Wall Conduit  
Bender**



**No. 763  
Steel Tube Bender**

**GREENLEE TOOL CO.**

1750 COLUMBIA AVE.

ROCKFORD, ILLINOIS

**TOOLS TO MAKE THE ELECTRICIAN'S JOB EASIER**



*We've been building them right  
for twenty years —*

# NEWARK

## STANDARD DRY TYPE TRANSFORMERS



Type P



Type O



Type N

We long ago developed standards of material, of design, and of construction that insure enduring transformer performance. These standards are strictly maintained, to safeguard a reputation of which we are justly proud.

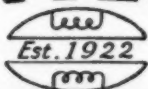
If you want transformers that need no fire-proof vaults, are acceptable where oil insulated types violate insurance codes, are light and compact, may be easily installed anywhere, and *require no maintenance*—then check with us on Newark dry type transformers. Capacities 1 to 75 kva.

**FULL DETAILS IN BULLETIN A-10**

*Write for a copy — today*

Newark also builds transformers engineered to special needs, comprised of a broad variety of standardized components. Tell us your transformer requirements—we can meet them. Deliveries are good on Newark transformers. If you have priority, we can deliver. Write us.

# NEWARK



## TRANSFORMER CO.

23 Frelinghuysen Ave. NEWARK, N. J.

**TRANSFORMERS FOR ALL PURPOSES**

## *More Gossip —*

### War Bond Record

Harry M. Heysinger, president, Davenport Electric Contract Co., one of the largest electrical contractors in Davenport, Iowa, is justly proud of the record his company made during a recent War Bond Campaign.

After the scores were tallied, it was found that his employees had pledged 14.3 per cent of their earnings for War Bonds. And that included the boys in the field also. Some of the electricians wanted to buy a bond a week. It's spirit like that that is going to make it tough for our enemies.



**FRANK E. MAHAN**, president, Benson Electric Co., Superior, Wis., compiles data on the electric winches and other power equipment his company is supplying for ocean-going tugs. Frank will do the wiring also.

### Nine-Foot Electricians

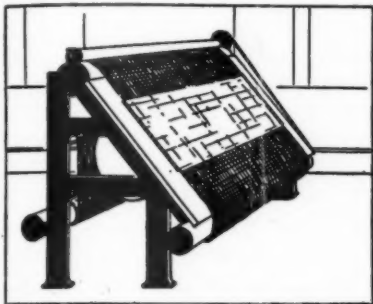
The Electric Construction Company of Tacoma, Washington is all set to employ about 40 nine-foot electricians in the construction of a temporary army barracks. No, there isn't a circus near town, nor has the company devised some secret stretching machine. Charles McPhail, president of the company, is using the old stunt we used to use to watch the ball game—stilts. Each electrician will be equipped with a set of three-foot stilts to enable him to work at the required height without the aid of ladders.

Mr. McPhail figures that the average electrician must climb up and down a ladder hundreds of times a day, making splices, pulling wires and boring holes through studding. In this job, ladders must be moved every 18 inches. Under the new set-up, he estimates the time saved will amount to about one-third the total job.

## Supplementary Lighting Methods

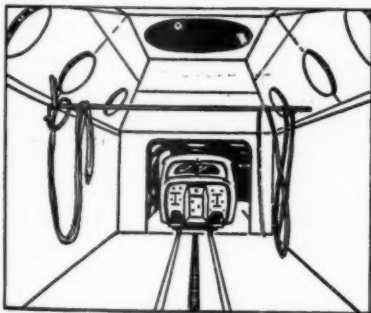
[FROM PAGE 30]

considerably with the specific task, panel brightness of the order of 100 foot-lamberts is a fair average.



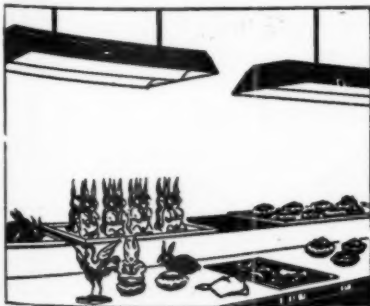
### 6. Vapor-Proof and Explosion-Proof

These units are designed for locations where corrosive vapor, inflammable gases or explosive dusts are likely to be encountered. Units of this character are recommended in moisture-laden atmospheres, such as steam processing, engine rooms, shower baths, also where gases and vapors are present from such processes as oil refining, paint and varnish making, spray lacquer painting.

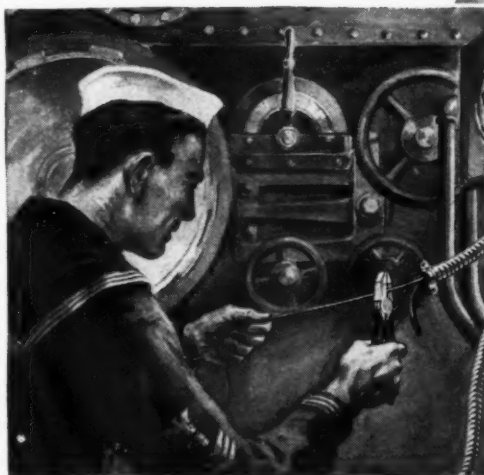


### 7. Fluorescent Lamp Trough Units

Sources of large luminous area and relatively uniform brightness may be obtained by employing fluorescent lamps in suitably designed specular trough reflectors. Units of this type produce high illumination of good quality. Because the radiant heat from fluorescent lamps is only one-quarter that of incandescent lamps for equal foot-candles, a source of this type can furnish several hundred footcandles without discomfort from heat.



*For the  
Army-  
For the  
Navy-  
For  
Industry  
Too-*



# KLEIN'S

*"Since  
1857"*



**W**HERE there's wire to be strung—where communication and power lines must be kept open—you will find Klein equipment doing its part, whether for the Army, for the Navy or for industry.

The preference of good workmen everywhere for Klein pliers dates back for nearly a century. Specializing in the supplying of tools and equipment to power, communication and transportation companies, the name "Klein" has stood for tops in quality "since 1857."

**ASK YOUR SUPPLIER**

Foreign Distributor: International Standard Electric Corp., New York

**Mathias KLEIN & Sons**  
Established 1857

3200 BELMONT AVENUE, CHICAGO, ILL., U.S.A.

*Save* **CRITICAL  
WAR  
MATERIALS**



*for Better Lighting  
..Bigger Production*

**USE  
SILVERED  
GLASS**

Step up your lighting to step up production. Install PERMAFLECTORS, the highly-efficient, silvered-glass reflector that picks up the maximum flux of light and puts it exactly where you need and want it! Over 70 designs, a correct shape for any and every purpose — providing engineered light control, for concentrated, intermediate and broad light distribution. Write for literature.

## FOR GENERAL INDUSTRIAL AND HIGH BAY LIGHTING

In new and remodelled plants, highly efficient general and localized lighting can be quickly, inexpensively secured with surface-mounted or suspended PERMAFLECTORS. Complete. Ready to install. Employ minimum critical war materials. Government-specified and Government-approved.

PICK UP THE WEAK SPOTS in your plant or production-line lighting with special Permalector "auxiliaries." Decrease spoilage, reduce accidents, increase production.



## New 500-WATT FLOODLIGHT

Ideal for all outdoor floodlighting applications. New 500-Watt floodlight is equipped with high-efficiency, silvered-glass PERMAFLECTOR, in any of 3 light distributions — broad, intermediate, concentrated. Rugged. Weatherproof. Rust-resistant. Complete. Ready to install.

**PITTSBURGH  
REFLECTOR CO.**



402 OLIVER BLDG. - PITTSBURGH, PA.

*Tear Off*

Clip to letterhead.  
Sign. Mail for  
complete information,  
prices.

## Supplementary Lighting Methods

[FROM PAGE 47]

### 8. Bench, Assembly and Inspection Operations

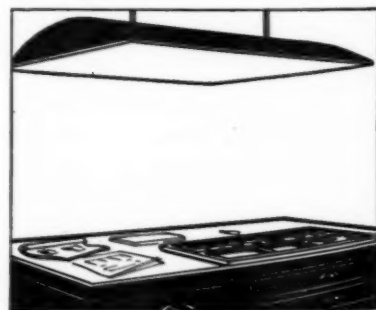
Bench work, assembly and inspection operations require a high level of good quality illumination which, in general, can be supplied by equipments of the type illustrated in sketches 7, 8 and 9.

Each job requires analysis to meet specific requirements. In some instances dual facilities must be provided, (1) diffuse lighting for certain defects, (2) directional lighting producing "glint" which may be essential to reveal others.



### 9. Large Area Sources of Uniform Brightness

Developed initially for lighting the type on imposing stones, units of this type are particularly applicable for those operations involving detail upon polished surfaces, such as scribing. If the source is uniformly bright, the detail on the specular surface will not be obscured in a confusing background, such as frequently results when small sources or a source of varying brightness is employed.

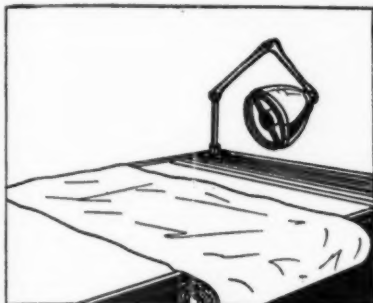


### 10. Directional Light

Surface flaws, irregularities in surface shape, pit marks, scratches, and cracks in materials are most easily seen by lighting which strikes the surface obliquely, casting a shadow and revealing the irregularities by shadow con-



trast. Thus wrinkles in roofing materials, are revealed by small shadows, emphasized by sharp directional light. The light may be undiffused for mat surfaces, but diffused at the source for polished or shiny materials.



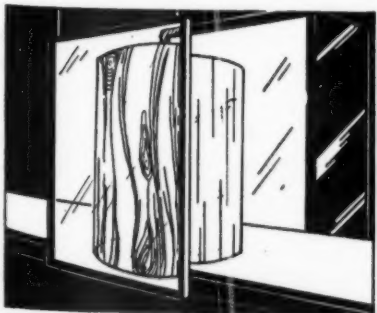
#### 11. Refraction

Transparent materials such as plate glass, bottles, bulbs, clear plastics, will reveal bubbles, blisters, cracks, chips and whorls by high lights or distortions. Alternating the observation between dark and luminous backgrounds introduces movement which aids in locating and identifying defects. Similarly, surface distortion and irregularities in polished sheet metal are revealed by the distortion of reflected images of straight lined bars or strips laid on the luminous background.



#### 12. Polarized Light

The detection of strains and defects in glass, mounted lenses, radio tubes, transparent plastics, is readily accomplished by polarized light. The strained areas appear as color fringes in the material. With transparent models of structures and machine parts, it is also possible to see how they are strained under operating conditions.



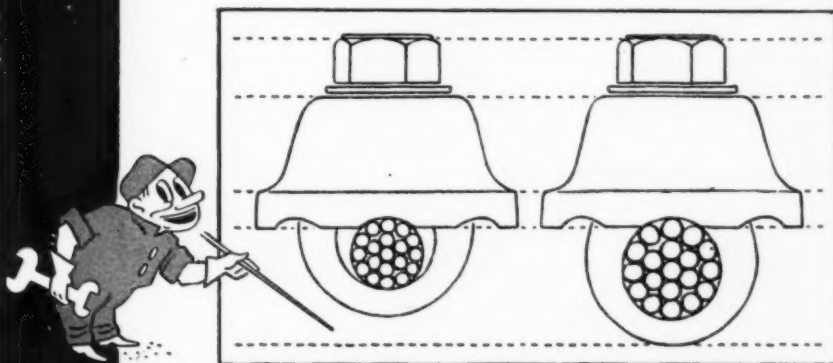
## 1 Lug - 5 Angles of Connection with the **BURNDY VERSI-LUG**



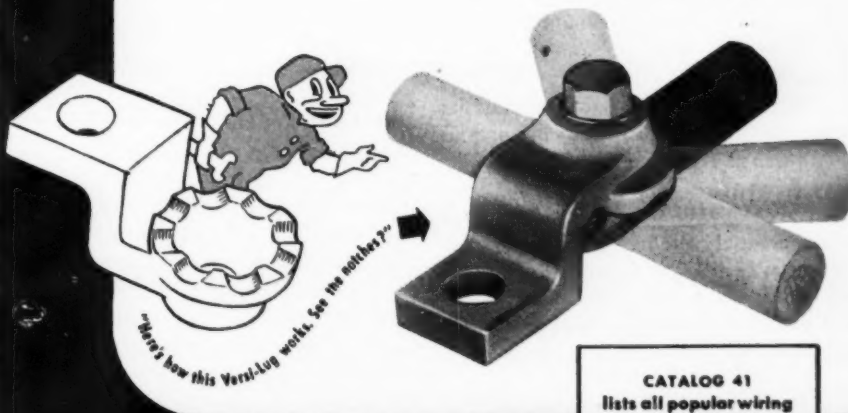
VERSI-LUG  
Type EA

*Here it is!*

One lug which does the work of five, making possible the connection of conductor to bar at any one of five different angles. Use the Versi-Lug on offset connections, to eliminate bending. Use the Versi-Lug with a large range of cable sizes. Finally, use the Versi-Lug with complete assurance that you are getting the most dependable connector money can buy. An ordinary wrench provides rapid, safe installation.



"This diagram shows how the connector can take a range of cable sizes. See how it closes down into a smaller space, with smaller cables. Though the diagram can't show it, the Versi-Lug is made of high strength, high conductivity material, forged bolts for extra strength, no exposed threads."



# BURNDY

ENGINEERING CO., INC. • 459 EAST 133rd ST. • N. Y. C.

CATALOG 41  
lists all popular wiring  
connectors. Write for  
your copy now.

## Induction Heating

[FROM PAGE 27]

of design, and may be clogged if the air is dirty. Units which use both air and water cooling even though they may not be as vulnerable, will still benefit by an adequate supply of clean air.

### Enclosed Units

The standard open set has frequently been used in a substation room supplied with filtered air through louvers in the wall, the room being kept under a slight positive pressure. To avoid the complication of specially constructed substations or the addition of ducts, an arrangement of a totally enclosed self ventilated set, recirculating and cooling the air has been successfully used. This type of construction permits location of the set at any point in the factory without consideration of the air.

A further simplification of the self ventilated enclosed design is shown in an accompanying sketch. Special brackets allow connection of the ventilating ducts directly to the brackets, so that a separate enclosing housing is unnecessary. The coolers can be omitted and a force ventilated arrangement can be supplied. Two methods can be used. We may either force clean air from outside through the set, and discharge into the room; or we may take the air from the room and discharge to the outside. In the first case the intake ducts "a" and "b" on the motor will be manifolded, and discharge would be either through an upper frame vent "d" or a lower frame vent "c". The generator would have its lower left frame vent connected with duct "g" for intake and for discharge upper vent "h" would be open. The other two vents "i" and "j" would be blocked.

In the second case the ducts would be on the discharge end of both motor and generator, and the intake air would be taken from the room.

An accompanying photo shows a totally enclosed set in which hydrogen cooling was used to improve efficiency, and to obtain a satisfactory and compact design for a large capacity 10,000 cycle unit.

### Bearing Lubrication Schemes

Methods of lubrication and bearing design are of particular interest to operators of high frequency units. High speeds are used, either 3600 or 1800 rpm. drives being necessary. Bearing

designs are made more difficult because of stresses due to unbalanced magnetic pull inherent to two pole induction motors. In the smaller bearing sets operating at 3600 rpm., cartridge type ball bearings are used to advantage. These may be of the sealed pre-lubricated type which require no attention for the first six or eight months even in severe service. They should be checked at this time, but in many cases it will be found that they can be operated for quite a while longer before it is necessary to remove and relubricate them.

In the larger sets several methods of lubrication have been used. In one scheme standard oil ring lubrication is supplemented by passing cooling water through passages in the bearing housing. Another scheme uses pressure lubrication to supplement standard oil ring lubrication. Perhaps the most satisfactory scheme is one in which bearings specially designed for pressure lubrication are supplied by direct connected oil pump for maximum reliability in operation. This has been used quite successfully on large 3600 rpm. totally enclosed hydrogen cooled sets.

### Starting Requirements and Voltage Control

Starting requirements for the motors driving high frequency generators are severe because of the greater weight, and  $WR^2$  of the inductor generator as compared with the conventional salient pole design. Starting time is long, and where the power system will permit it, full voltage starting is preferred. Because of these unusually severe starting characteristics it is the general practice to start these sets not oftener than once a day, and keep them turning over even though the load may only be intermittently applied.

The control of the voltage of these generators has been a gradual development, changing to suit the development of the art and the increase in variety of applications. The earlier melting applications used automatic voltage regulators to control the voltage, holding it to some predetermined value as the power factor of the charge due to the changes with temperature would gradually change. To keep the power factor from drifting too far from unity, it was also found necessary to readjust the amount of capacity reactance which is used to bring the very low power factor of the load to a reasonable value. It is found that these machines, which inherently have long time constants so that they are sluggish in response to changes in excitation, are extremely

sensitive to changes in the tuning capacitance, sudden changes in capacitance values to make the load current more leading, cause instantaneous rise in voltage and vice versa. For this reason precautions should be taken never to divorce the shunt connected capacitors from the load, leaving the capacitors alone on the generator. This will cause a voltage the maximum value of which may be limited only by the saturation of the machine. This voltage will cause failure of the capacitors, and instruments and may cause failure of the generator insulation. Advantage is taken of this characteristic in many short time heating cycles, by tuning the circuit to 50 to 60 percent leading power factor at the start of the heating cycle, this gradually changes as the piece heats up and the power factor becomes more lagging, so that at the end of the heating cycle the power factor is only slightly lagging. For short heating cycles a fixed preset excitation current is used, for longer cycles it may be necessary to change this either by suitable regulator or by some arbitrary timing for field changing contractors.

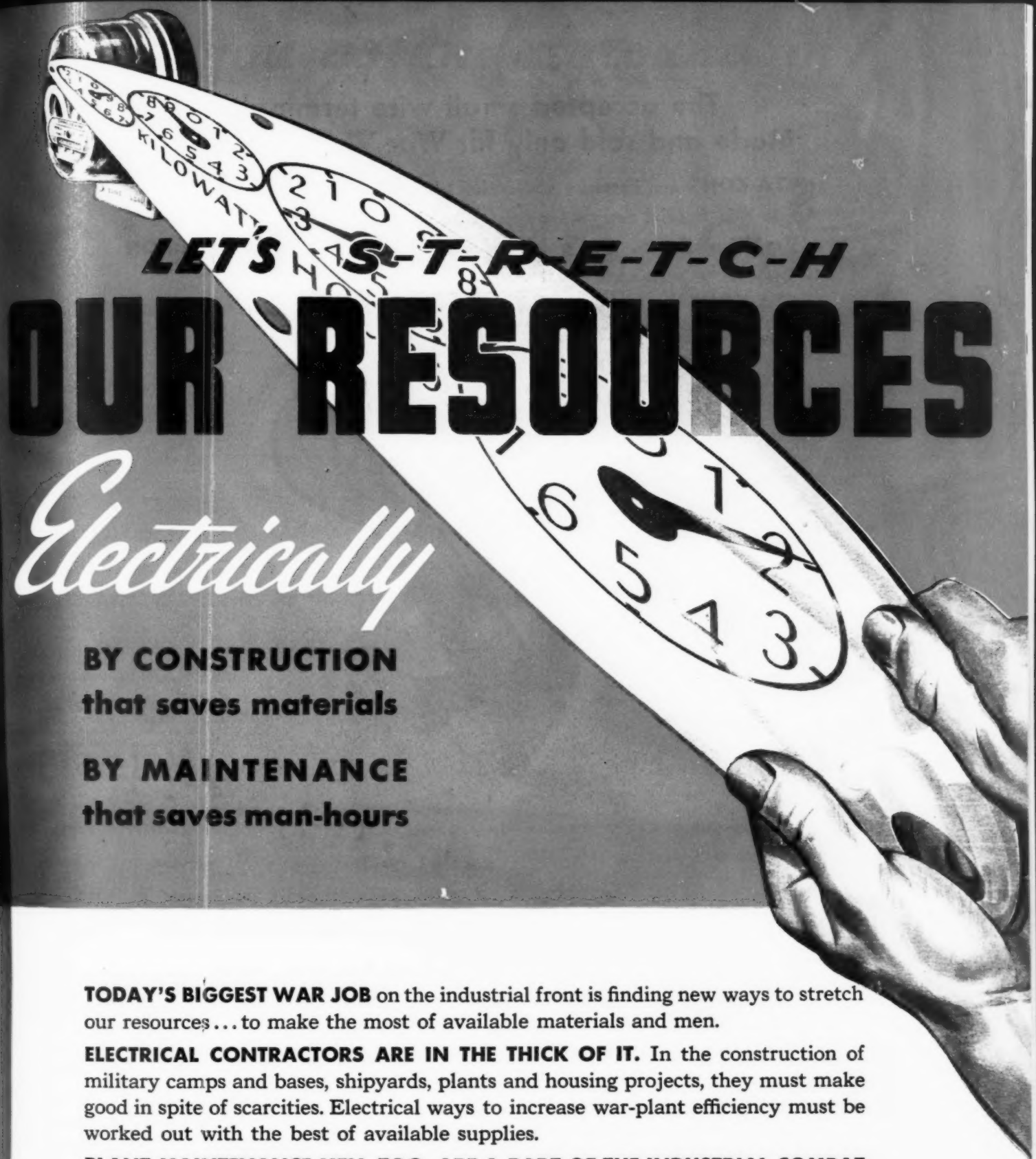
As long as single loads of the same characteristics are supplied in sequence the preset excitation and fixed tuning is quite satisfactory, but a more satisfactory load factor on machine can often be obtained by using it for several loads of different characteristics which may overlap each other. In such cases no single preset excitation is adequate for all cases and the need for a regulating system with particularly good response is evident. If quick response of the generator voltage cannot be obtained, the increase or decrease in voltage with change in load may result in an unsatisfactory product, particularly in short time cycle jobs. To meet such conditions quick response excitation systems are necessary and have been worked out for recent applications. The simplest of these involves the use of apparatus excitation for the generator exciter and a bucking circuit by means of which the exciter voltage can be rapidly forced down when necessary.

The greatly increased use of induction heating, melting, hardening and processing due to the requirements of war industry is important to all electrical men concerned with the installation of the equipment, wiring connections between the various parts of the apparatus and the maintenance of the equipment in service. However, the fundamentals of all good installation and maintenance practice are still valid.









# LET'S ~~S-T-R-E-T-C-H~~ OUR RESOURCES

*Electrically*

**BY CONSTRUCTION**  
that saves materials

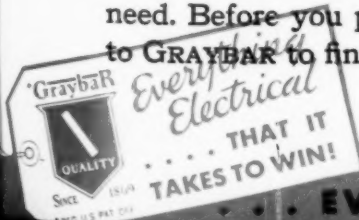
**BY MAINTENANCE**  
that saves man-hours

**TODAY'S BIGGEST WAR JOB** on the industrial front is finding new ways to stretch our resources... to make the most of available materials and men.

**ELECTRICAL CONTRACTORS ARE IN THE THICK OF IT.** In the construction of military camps and bases, shipyards, plants and housing projects, they must make good in spite of scarcities. Electrical ways to increase war-plant efficiency must be worked out with the best of available supplies.

**PLANT MAINTENANCE MEN, TOO, ARE A PART OF THE INDUSTRIAL COMBAT TEAM.** Their care of electrical equipment... old and new... must keep it fit for full-scale output. They must forestall the loss of precious man-hours due to electrical breakdowns.

**SUPPLY LINES FOR THIS INDUSTRIAL WAR FRONT** are just as critical as anywhere else. That's why makers of the electrical equipment that's helping industry stretch its resources, count on GRAYBAR to get it quickly to the point of greatest need. Before you pass up any electrical means of boosting production, put it up to GRAYBAR to find a way.



... EVERYTHING ELECTRICAL ... THAT IT TAKES TO WIN

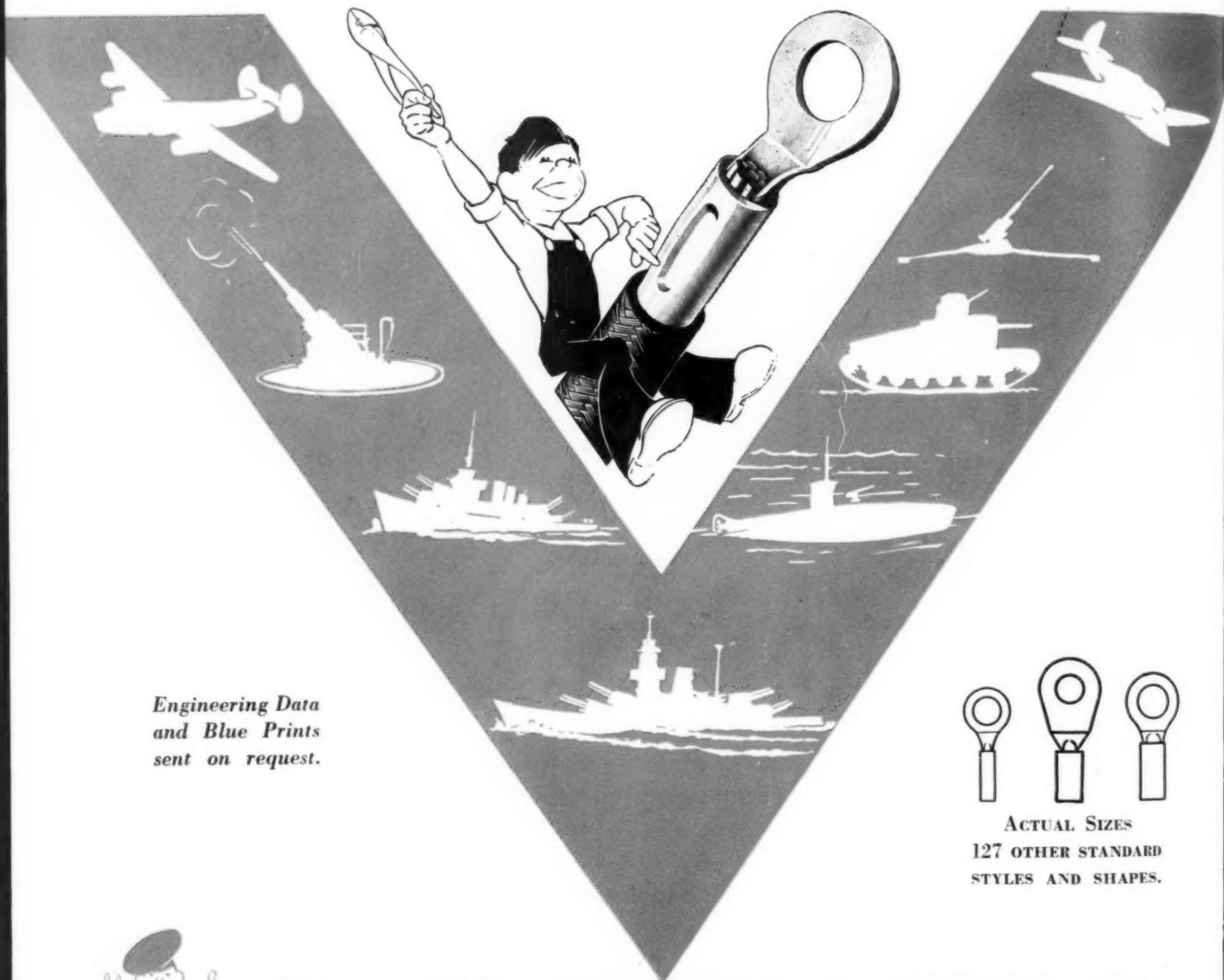
# STA-KONS

The accepted small wire terminals.  
Made and sold only for War Victory Program

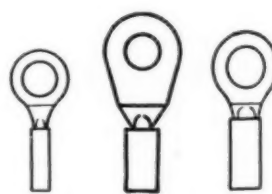
**STA-KONS** are Pressure (Solderless) Connectors. For all wire sizes #22 to #4. Special designs for special wiring problems.

Rapid installation. One quick indenture (Stake) with simple **STA-KON** tool makes a permanent joint strong as the wire itself.

**STA-KONS** are in use in all branches of the Service, where time-saving, safety, and economy are prime essentials.



Engineering Data  
and Blue Prints  
sent on request.



ACTUAL SIZES  
127 OTHER STANDARD  
STYLES AND SHAPES.



**THE THOMAS & BETTS CO.**  
INCORPORATED

MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

Factory, Engineering and Executive Offices, Elizabeth, N. J.



LET'S S-T-R-E-T-C-H OUR RESOURCES... *Electrically*



*when you go underground in*

**ORANGEBURG**

*Conduits*



**ORANGEBURG *Standard***

Orangeburg *Standard*, encased in concrete, is the most economical construction where duct-banks of four or more ducts are involved. For nearly half a century this conduit has been serving leading utilities, railroads, municipalities, and industrials, protecting power cables underground with this type of construction.

**ORANGEBURG *NOCRETE***

Orangeburg *NOCRETE* is most economical for field services as it can be installed underground without concrete encasement. Its characteristics of mechanical strength combined with exceptional deflection make it ideal for services where ground stresses and settlement are encountered.

Conserve critical materials with Orangeburg Conduits? Certainly—for this pitch-impregnated fibre conduit *itself* is “non-critical”. Of more importance is the fact that Orangeburg saves cable from early failure by providing *complete* protection—and cable is “critical”.

There are logical reasons for Orangeburg’s *complete* cable protection. This conduit is immune to cor-

rosion, and has water-tight joints. Thus ground waters, whether acid or alkaline, *do not reach and ruin the cable sheath.*

Furthermore, Orangeburg saves *hours* in installation time. As it is light in weight and comes in convenient lengths, it is easily handled. Although it is strong and durable, it can be cut with a wood saw in a matter of minutes. It assembles and installs faster—and at a lower cost—than other conduit.

And it is available *now* from GRAYBAR ELECTRIC CO., Inc.

**ORANGEBURG** *Conduits*

*A lasting name underground for Forty-Nine Years*

MADE AT ORANGEBURG, NEW YORK, BY THE FIBRE CONDUIT COMPANY, 292 MADISON AVE., NEW YORK CITY

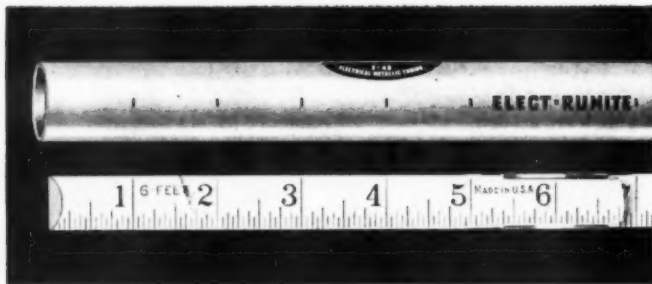
10-FC 3

**MOBILIZED AT THE POINT OF NEED...**

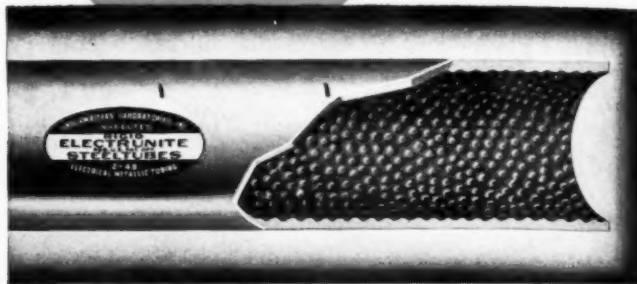


# 3 things this Streamlin

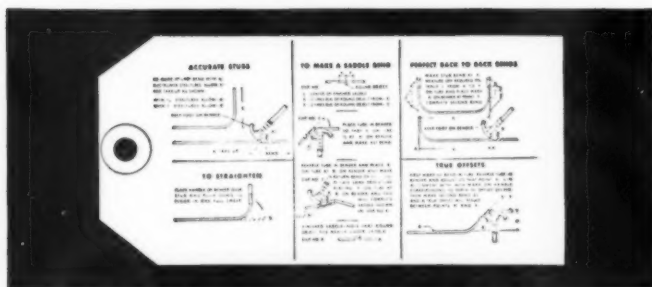
**SPEED  
ESSENTIAL WAR  
CONSTRUCTION**



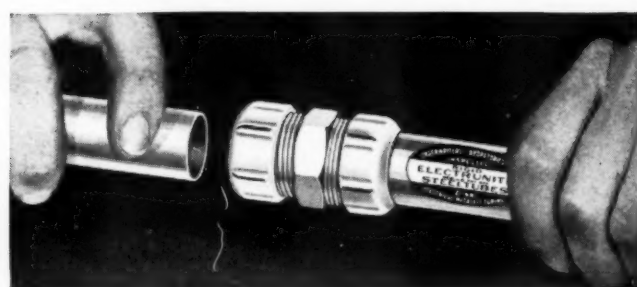
Every length of **ELECTRUMITE STEELTUBES** is accurately marked off in feet and inches. This, combined with the bender, gives you the **STEELTUBES** bending system.



Thousands of tiny rounded knobs on the inside surface (Patent No. 1,962,876) of "Inch-Marked" **ELECTRUMITE STEELTUBES** lift wires from the wall, reduce wire pulling effort as much as 30%.



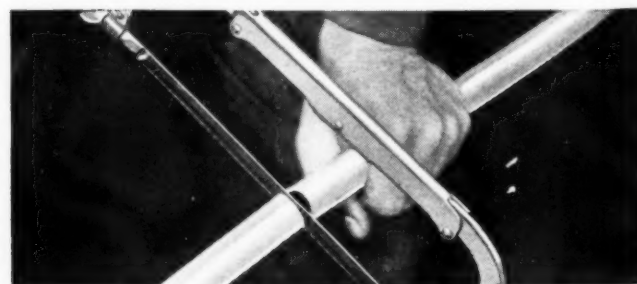
These simple diagrams clearly illustrate the bending system. They're on one side of the bending instruction tag. On the other side are detailed instructions. An ample supply comes with each shipment.



Compression-type fittings eliminate threads. Connections are made without turning the tubing. Simply cut and bend **STEELTUBES** to dimension and no matter how close the quarters, it's easy to install.



This bender is a part of the **ELECTRUMITE STEELTUBES** bending system. It enables you to bend **STEELTUBES** with greater accuracy and ease than ever before. Instructions are cast in, cannot be lost.



Clean, fast cuts are easily made with an ordinary 32-tooth hacksaw on this ductile steel. **STEELTUBES** may be reamed with a file, pocket knife or the handle of your pliers.

## Republic

# "INCH-MARKED"

THE ELECTRICAL RACEWAY WITH A C



LET'S S-T-R-E-T-C-H OUR RESOURCES... *Electrically*

# Streamlined Raceway will do:

**PROTECT  
VITAL WIRING  
WITH STEEL**

**SAVE STEEL  
FOR FIGHTING  
TOOLS**

War construction must move rapidly. Time gained can be a strong ally—time lost, an insidious fifth columnist. "Inch-Marked" ELECTRUNIT STEELTUBES saves time in electrical installation.

Electrical wiring is vital to war production. Damage to lines means loss of power, shut-downs, wasted time. "Inch-Marked" ELECTRUNIT STEELTUBES protects wiring with the strength and toughness of steel.

Steel is needed in tremendous tonnages for planes, tanks, ships, guns, shells. "Inch-Marked" ELECTRUNIT STEELTUBES used instead of ordinary threaded steel conduit saves a substantial tonnage of steel which may be used to increase our armament.

This streamlined raceway is approved by the National Electrical Code—for exposed, concealed or concrete slab construction. Any U. S. Government agency can use it by specifying ELECTRUNIT STEELTUBES or equal.

Look at the features of "Inch-Marked" ELECTRUNIT STEELTUBES illustrated on these pages. Then specify it on your next job.

## **STEEL AND TUBES DIVISION** REPUBLIC STEEL CORPORATION CLEVELAND • OHIO

Berger Manufacturing Division • Niles Steel Products Division  
Union Drawn Steel Division • Culvert Division • Truscon Steel Company  
Export Department: Chrysler Building, New York, New York

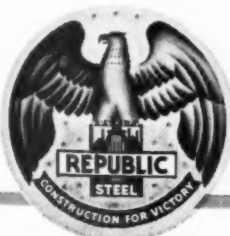


Photo by U. S. Army Signal Corps.

Because "Inch-Marked" ELECTRUNIT STEELTUBES is designed for use with compression-type fittings, extra thickness in the steel wall is not required as a base for threading. Hence, the difference in wall thickness between this streamlined raceway and ordinary threaded steel conduit is saved—and it's a substantial saving. Every time you install 100,000 feet of  $\frac{1}{4}$ " size in place of threaded conduit, you save enough steel to build a 30-ton tank.



Steeltubes in concrete? Absolutely! It is strong and tough—resists structural abuse. It is remarkably easy to handle and install—especially so in narrow spaces between pans, in long bent runs and other "tight" places. You don't turn the line—only the nuts or couplings. It takes up less space in shallow slabs than old-style threaded conduit. Millions of feet already installed in concrete slab construction attest to its outstanding performance.

# ELECTRUNIT Steeltubes

Reg. U. S. Pat. Off.

THE CONTINUOUS FOOT-RULE ON EVERY LENGTH!

**MOBILIZED AT THE POINT OF NEED...**





**BLACKOUT** 100%



**VENTILATION** 100%



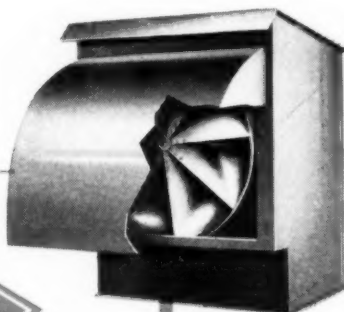
**PRODUCTION** 100%

*Nothing must be allowed to interfere with urgent war production — not even blackouts! As windows are tightly closed and blacked-out, shrewd management has gratefully turned to carefully engineered, effective, low-cost Ilg Blackout Ventilation. Hooded louvers provide fresh air inlets . . . hooded Ilg Power Roof Ventilators induce rapid air change for cool, comfortable working conditions . . . swiftly and quietly remove "worn-out" air, odors, excessive heat, steam, dust and harmful vapors. Ventilation by this power system is positive and uniform regardless of the direction or velocity of the wind. Bought as emergency equipment for many plants, Ilg ventilation makes immediate friends . . . executives vow never to return to drafty, disagreeable, dangerous window ventilation . . . look forward to many long years of improved working conditions. Get free Blackout Bulletin No. 304!*

**ILG ELECTRIC VENTILATING CO.**  
2879 N. CRAWFORD AVE., CHICAGO, ILL.  
Offices in 38 Principal Cities



**VITALIZED VENTILATION**  
AND AIR CONDITIONING  
**AIR CHANGE...NOT JUST AIR MOVEMENT!**



*ILG Power Roof Ventilator has Self-Cooled Motor Propeller Fan in weather-tight roof penetration. Cut-away shows Blackout Hood permitting unrestricted air passage without light transmission. Wide range of sizes.*



**LET'S S-T-R-E-T-C-H OUR RESOURCES... Electrically**

# There's a 3 Way Profit in Climbing Aboard the Teletalk Bandwagon NOW

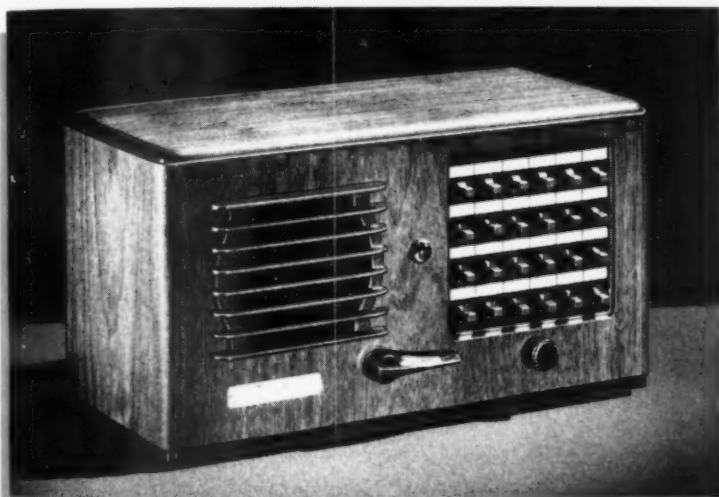
WEBSTER ELECTRIC

## Teletalk

REG. U.S. PAT. OFFICE



Busy defense plants need Teletalk's time-saving features now . . . You need the three-way profit which its sale and installation brings . . . And you can certainly depend on Teletalk for future business.



Any electrical contractor, who is located where industrial business exists and is familiar with industrial installations, is missing a big bet by not becoming familiar with Teletalk, the ease and simplicity of its installation, the profit that accrues to him through the sale of material and labor, and the ease with which it can be sold after proper demonstration.

And it's so easy to learn about the profit you can make from the sale and installation of Teletalk. The Graybar man who calls upon you can tell you all about it. He *knows* because he has sold Teletalk. He has appraised offices and plants where Teletalk is needed. He has planned systems for his prospects. He has specified the material required and has estimated the labor involved. Through this knowledge he has sold Teletalk systems and has made a good profit by doing so.

He'll tell you how you can do it. All you have to do is ask him.

Teletalk has all the advantages that make for profitable sale by electrical contractors. It is the leading and best known system of its kind. It is nationally advertised. It carries a good margin of profit and it is distributed nationally by Graybar. Confer with a Graybar man or write us direct.

Teletalk Intercommunication Systems range in size from 5 to 24 stations—most of them available with special features such as telephone handsets for private conversation, annunciators, etc.

Teletalk Paging Systems are available for both office and factory paging. This is easy-to-get business now. Talk to all your industrial customers about it.

Licensed under U. S. Patents of Western Electric Company, Incorporated, and American Telephone and Telegraph Company.

WEBSTER ELECTRIC COMPANY, Racine, Wis., U.S.A. • Est. 1909.  
Export Dept.: 100 Varick St., N.Y.C. • Cable Address: "ARLAB", N.Y.C.

# WEBSTER



# ELECTRIC

"Where Quality is a Responsibility and Fair Dealing an Obligation"

MOBILIZED AT THE POINT OF NEED...



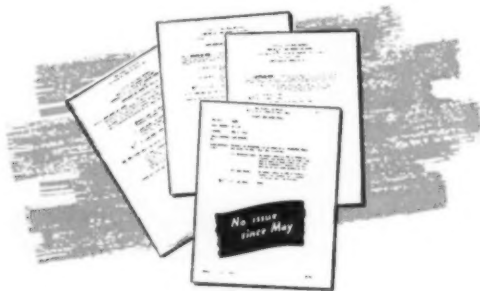
# A FACTUAL STORY ABOUT OR SHERARDIZING OF



Federal Specification Zinc-Coated Rigid Steel Conduit No. WW-C-581a calls for 4 one minute dips Preece Test (new emergency specifications permit 2 dips).



"Sherar duct" Conduit is made to WW-C-581a averaging 8 dips. Peace-time quality under war emergency maintained due to plentiful supply of zinc dust used exclusively in Sherardizing process.

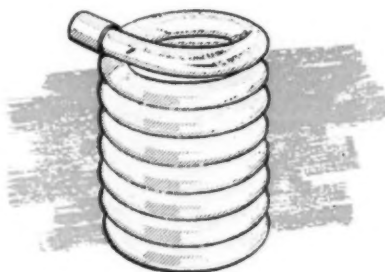


At no time have we been pinched for Zinc Dust, used exclusively in the Sherardizing process.

No priority for Sherardizing zinc is required.

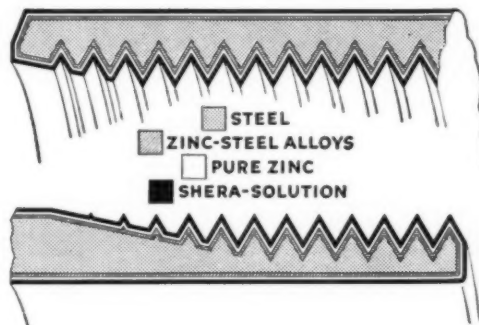
Sherardizing is the alloying of zinc with surface of steel with additional deposit to any amount.

The alloying of zinc with steel surface, possible only in heat treatment of Sherardizing process, seals the pores, over which deposit of zinc forms to any desired thickness.



Steel requiring bending or fabrication is limited as to amount of zinc deposited by any process. Experience of over 30 years in production of "Sherar duct" Conduit has taught that zinc equal to 8-10 dips Preece Test may be satisfactorily bent into the job without fracture, cracking or flaking.

Uniformity of zinc deposit and protection from rust, when formed on zinc-steel alloy, is exacting due to method of gas depositing zinc, thus all threads of pipe are equally treated as walls of pipe.



LET'S S-T-R-E-T-C-H

OUR RESOURCES...

*Electrically*



# SHERARDUCT CONDUIT

## ANY STEEL PRODUCT

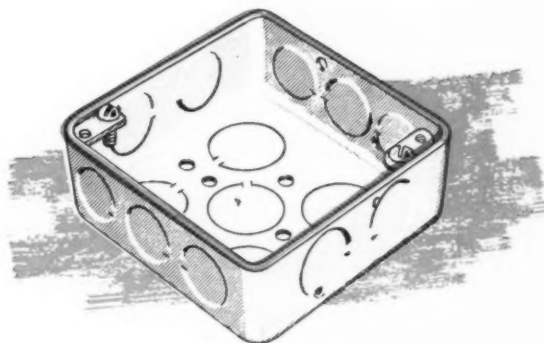
Following hills and valleys of metal the deposit is of uniform thickness and free from thick and thin spots of zinc.

Superior to hot galvanizing methods, threads are sharp and clean and as fully protected from rust as walls of pipe, which is impossible in hot galvanizing process. Threads of couplings are likewise Sherardized and fully protected from rust.



Chicago and Northwestern Railway Station.  
Built 1905. Original Sherarduct still being used.

"Sherarduct" Conduit is today's foremost zinc treated conduit. Tests show it bends more readily, fabricates into the job easier and "lasts as long as the building stands." Sherarduct has always been specified and installed wherever electrical conduit of the highest quality is demanded. Present day emergencies have not changed that quality.



National Electric "Redegee" Sherardized Outlet Boxes and Covers are rustproofed by the same process as "Sherarduct" Conduit. There is no shortage of zinc dust for Sherardizing (rustproofing) National Electric Boxes and Covers.

All knockouts are clean cut; box edges are trimmed square; covers are interchangeable; and they are made from No. 14 U.S.S. Gauge steel. Look for the "Redegee"—an assurance against rust and poor workmanship.



**National Electric  
Products Corporation**  
Pittsburgh, Pa.

**MOBILIZED AT THE POINT OF NEED...**

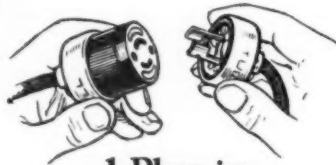


# UNINTERRUPTED PRODUCTION IN DEFENSE PLANTS

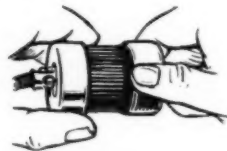
BOMBERS or Bullets — Tanks or Trucks  
Wherever Plants Produce for War  
HUBBELL *Twist-Lock* Insures  
UNINTERRUPTED PRODUCTION

**They never  
disconnect  
accidentally!**

**A twist  
of the cap . .  
and it locks!**



1. Plug in -



2. Twist -



3. They're locked!



*Twist-Lock* Devices eliminate time-losses and annoying delays because they "stay put" — are vibration-proof — assure a lockfast electrical connection under all conditions — are available polarized and grounded for safe operation!

*Twist-Lock* Devices are widely used by industries wherever lockfast electrical connections are needed to insure safe, uninterrupted production.

## HUBBELL *Twist-Lock* DEVICES

HARVEY HUBBELL, INC.  BRIDGEPORT, CONN.



LET'S S-T-R-E-T-C-H OUR RESOURCES...

*Electrically*

# THE ROLE OF

# RUBBER SHEATHED Cords and Cables IN War WORK



Since 1920, when TIREX rubber-sheathed Cords and Cables were introduced, flexible, rubber insulated conductors protected by hard service, abrasion resistant rubber sheaths have been the standard means of carrying power to portable electrical equipment. In various sizes and types they have served equally well for small tools or huge electric shovels. They have played their part so well that their importance has frequently been overlooked.

Their role is exactly the same during the war but its importance is emphasized by the shortage of rubber upon which they have depended so largely for quality of both insulation and sheath. They must still carry power to the portable tools and equipment in nearly every essential war industry. They must play an increasingly important part in the rapidly expanding war production.

TIREX Cables — modified to comply with war production board rulings to conserve rubber — are protected with a selenium cured rubber sheath that is highly resistant to abrasion. Electrically they are entirely adequate for the exacting type of service expected of them. They will stand up to hard, rough work and their life may be prolonged indefinitely by a little extra care in keeping them free from grease and oil and away from heat and light when not in use.

TIREX Cords and Cables have insulation designed for electrical stability, their selenium rubber sheath is tough and abrasion resistant. They are flexible and can be depended upon for long economical performance. Essential industries on vital war work cannot find a better answer to their cord and cable problem.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

# Simplex

## WIRES and CABLES

MOBILIZED AT THE POINT OF NEED...







# Shows You WHERE and HOW to Improve Lighting to Meet War Production Demands

LOOK... PAGE 6 SHOWS HOW MUCH LIGHT WE NEED FOR THAT NEW DEPARTMENT!



- It's Important to Get the Answers to Questions Like These:**
- Why Does Good Lighting Conserve Nervous and Physical Energy?
  - What Effect has Lighting on the Accident Rate?
  - What are the Five Factors Involved in the Seeing Task which Determine the Amount of Lighting Required?
  - How may Maximum Efficiency be Secured from the Present Lighting System?
  - What factors must be Considered in Selecting the Most Effective Lighting Units?
- You'll find the answers to all these and many other important questions, as well as the solution to 21 everyday lighting problems in your complimentary copy of the new booklet, "Benjamin Specifications for Productive Lighting".

## Free to Plant Executives, Specifying Engineers and all others concerned with Productive Lighting

Lighting is high on the list of recommended things to check and improve to increase production. Why? Two reasons: First, because good lighting is basic to good seeing and without good seeing there can be no efficient production. Second, because lighting improvement in many plants has all too often not kept pace with plant improvement in machines and methods.

### Lighting Can Help You Meet War Production Demands

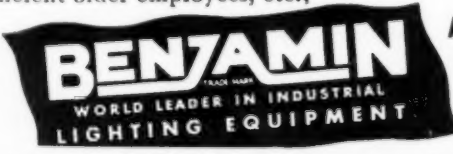
Night shifts, overtime, six and seven day weeks and high speed sustained production have put a tremendous tax on the eyes, health and reserve energy of employees. War production, therefore, demands lighting which will make seeing quicker, easier and less tiring... lighting that will prevent eye fatigue, insure keener eyes and a quicker hand, and provide a cheerful environment for both day and night workers. In this and a myriad of other war production problems such as maximum utilization of floor areas, lighting of hazardous locations, the problem of the visually deficient older employees, etc.,

improved lighting is an important factor.

### You Need this New 36-Page Book to Assist You in this Important Job

For the vitally important job of checking lighting and planning lighting you will find invaluable, the data contained in the new "Benjamin Specifications for Productive Lighting in War Plants". Here in this new book is working information, up-to-minute, authoritative, which you can put to immediate use. In this manual are 21 lighting problems and their solutions, selected from those most frequently submitted to the Benjamin Engineering Department. The answers to these problems are complete, so that you can specify the proper lighting equipment without further delay. This new 36-page manual takes you step by step through the entire procedure of checking, analyzing and specifying lighting equipment. You will want a copy for yourself and your associates. A request on your letterhead or on the coupon will bring you a copy by return mail without cost or obligation.

Published by



Available from your  
**GRAYBAR LIGHTING SPECIALIST**  
or the **BENJAMIN ELECTRIC MFG.**  
Dept. H, Des Plaines, Illinois



LET'S GET-TOGETHER OUR RESOURCES... *Electrically*

**SERVICE  
AND  
ECONOMY**

## WITH THE BRYANT FS4-NA "NO-BLINK" STARTER

TIME-PROVEN "GLOW  
SWITCH" LENGTHENS LAMP  
LIFE WITH PROPER PREHEAT  
AND PERFECT STARTS



"SURE-FIRE" THERMAL CUTOUT  
ELIMINATES BLINKING OF DEACTI-  
VATED LAMPS AND SAVES CURRENT

FULLY



AUTOMATIC

**ADEQUATE PREHEATING**  
of lamp electrodes provides perfect starts. Lamp life is prolonged as the vital emission material is not wasted by continued starting attempts. Starters do not wear themselves out with continued flashing. Ballasts last longer because overheating is prevented.

**ANNOYING BLINKING**  
is stopped immediately when the lamp becomes deactivated. When a worn out lamp is replaced, the starter functions at once—automatically. No cooling off period or reset of the starter is necessary.

Maintenance and replacement costs are reduced because these starters do not wear themselves out trying to start a deactivated lamp. Ballasts stay cool and last longer. Power is saved because the power is reduced to less than 1 watt when a deactivated lamp is locked out.



**THE BRYANT ELECTRIC COMPANY, BRIDGEPORT, CONN.**

NEW YORK • CHICAGO • SAN FRANCISCO • LOS ANGELES

**MOBILIZED AT THE POINT OF NEED...**





# WHERE *Power* LOAFS

In Hundreds of Great War Plants BullDog Bus Duct Systems Are Answering the Problem of 24-Hour Operation . . . Under Peak Loads . . . at Low Cost



POWER DIRECT TO EACH MACHINE is extremely well illustrated by this view in one of the world's largest airplane engine plants. Only a few minutes work is required to connect or disconnect each machine. Any machine, or a whole production line, can be moved at will—or can be down for "retooling"—without delay or interruption to the rest of the line.

Horsepower, on the job, is America's mightiest weapon of war. But power *can* sabotage the best laid production plan. Constant delays and interruptions *can* add up to a staggering total of idle hours.

The choice, very largely, is one of equipment for power and light distribution. It's the choice between old-fashioned, costly, complicated wiring systems, and modern, flexible bus duct systems.

It isn't hard to balance this electrical ledger. The credits are on the side of BullDog Plug-in Bus Duct Systems—whether you figure on the basis of efficiency, ease of installation, speed of conversion or cost of maintenance.

The best proof of this fact is in the ever-growing list of both new and converted plants—most important builders of vital war materials—which have set their production records with the aid of BullDog equipment.

## THESE IN BRIEF ARE BULLDOG'S CHIEF ADVANTAGES

Power and light *where* they are needed, *when* they are needed.

System can be installed in new plants without waiting for machine layout . . . machines can go to work as soon as the roof is on.

Tool set-ups can be changed, machines moved, without interrupting light or power.

Power operates at higher efficiency, with less voltage loss, than in any other system.

An enclosed system, protected against breakdowns, sabotage and short circuits.

System is engineered for maximum efficient use of war-scarce materials. No rubber needed. Valuable aluminum saved for more critical war purposes.

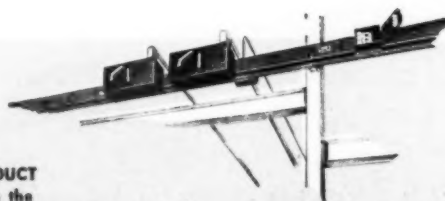
Installation in fraction of time required for old-fashioned wiring.

Standard, interchangeable sections—100% salvable. Instantly convertible from one production set-up to another.

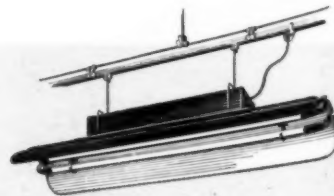
BUY WAR BONDS AND STAMPS



INDUSTRIAL TROL-E-DUCT  
Moves the Power with the  
Tool or "Load"



BUStribution DUCT  
"Plug-in" Power Direct  
to Each Machine



UNIVERSAL TROL-E-DUCT  
Plugs in the Lighting  
As and Where Needed

BULLDOG "PLUG-IN" SYSTEMS—THE ARTERIES THAT SUPPLY POWER AND LIGHT FOR WAR PRODUCTION



LET'S S-T-R-E-T-C-H OUR RESOURCES...

*Electrically*



# ... PRODUCTION LAGS

Throughout American Industry the New Bulldog Vacu-Break Safety Switch is Helping to Keep Power on the Job . . . Speed Production—Reduce Maintenance Cost

The finest electrical distribution system in the world is no better than its switches. The right type of safety switches can keep power on the job every minute, free from current losses caused by lost motion in switch operation, by pitted or burned out contacts, by loose fitting contact devices.

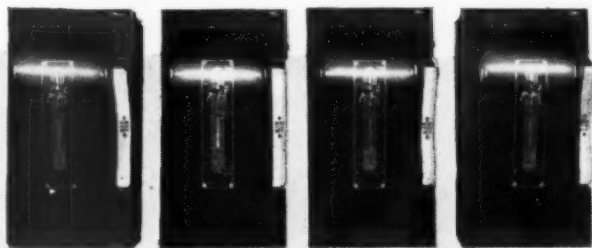
The new Bulldog Vacu-Break Safety Switch is that right type of switch, designed to meet today's emergency needs, to carry the loads of round-the-clock production schedules, to stand the wear and tear of constant operation and lack of adequate maintenance time.

Industry has been quick to see the advantages of the New Vacu-Break Switch—hundreds of the country's greatest war plants are specifying it as standard equipment, sure of its ability to "stand the gaff."

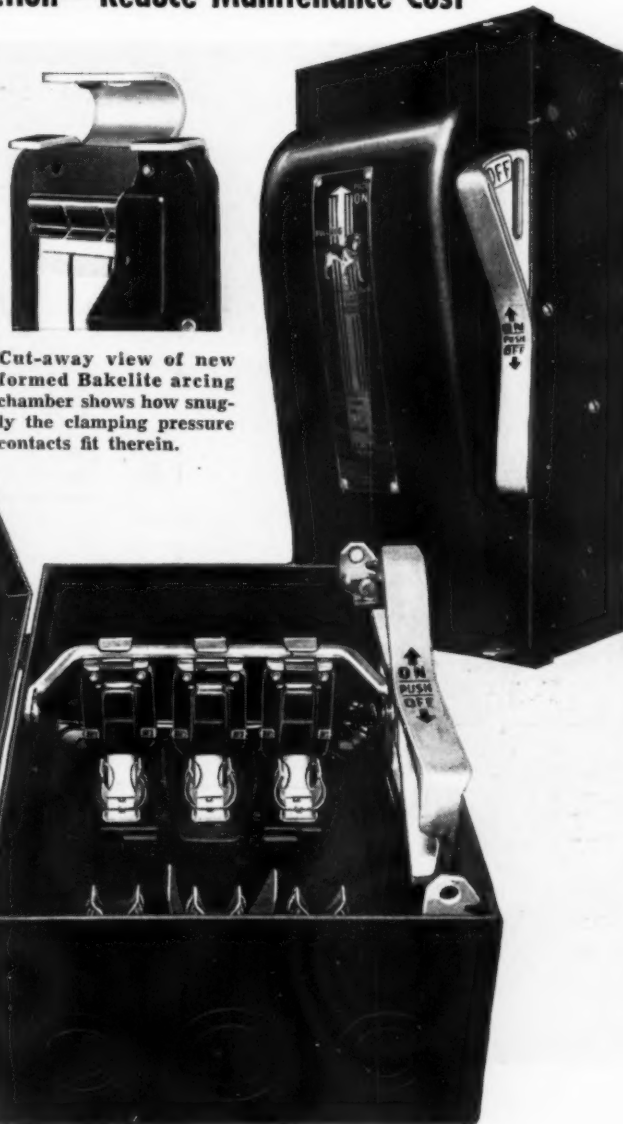
## PLUS FEATURES OF THE FRONT OPERATED VACU-BREAK SAFETY SWITCH

- 1 "Clampmatic" SWITCH CONTACTS: Provide in a very simple way, "Clamp type pressure" when switch contacts are closed, and at the same time, the switch operates more easily and quickly than switches having only ordinary pressure contacts.
- 2 QUICK ACTION MECHANISM: Assures positive "ON" and "OFF" operation. Provides front operation and enhances modern streamlined appearance.
- 3 FORMED BAKELITE "ARCING CHAMBERS": Confine arcs—prevent burning and pitting of contacts. Rugged current-carrying parts reduce maintenance and replacements.
- 4 SIMPLIFIED OPERATING MECHANISM: Greatly reduces parts necessary for smooth, positive and firm operation. No "lost motion" in operating mechanism.
- 5 WIRING ROOM—AMPLE yet COMPACT: The neat trim condition of switch interior is designed to provide maximum wiring space without sacrificing overall compactness.

Available in Master (Type A) and Standard (Type C)  
30 Amp. to 200 Amp. inclusive



Rocker type handles positioned inside lines of cabinets enhance their fine streamlined appearance.



Cut-away view of new formed Bakelite arcing chamber shows how snugly the clamping pressure contacts fit therein.

**BULLDOG**  
ELECTRIC PRODUCTS CO.  
DETROIT, MICHIGAN

Bulldog Electric Products of  
Canada, Ltd., Toronto, Ontario

Field Engineering Offices  
in All Principal Cities

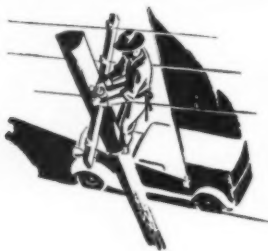


MANUFACTURERS ALSO OF SafToFuse PANELBOARDS, CIRCUIT MASTER BREAKERS AND SWITCHBOARDS—FOR LIGHT AND POWER

MOBILIZED AT THE POINT OF NEED...



# NEW WAKEFIELD UNITS FOR EMERGENCY LIGHTING.. THE *DAMAGE CONTROL LIGHT*



At night, if electric power breaks down . . . or away from power lines . . . or in smoke-filled atmospheres . . . your customers will appreciate this Wakefield Damage Control Light to help speed emergency repairs.

Developed for the Navy, this powerful, completely portable lighting unit has now been released for use by industrial plants, fire departments, power companies, telephone and telegraph companies.

Overvoltage use of a "sealed beam" lamp,

Navy type SB-1, which greatly resembles the lamp used in modern automobile headlamps provides light of high intensity. And it is precision-focussed for top efficiency. Unlike automobile headlights, the clear face of this lamp transmits light without diffusion.

This new Wakefield Damage Control Light is available in three models: (1) Powered by four Navy type wet cells of spill-proof construction; (2) by six No. 6 dry cells; (3) with standard storage battery. Write for details. The F. W. Wakefield Brass Co., 102 Contract Park, Vermilion, O.

*Wakefield also makes top-notch fluorescent fixtures to speed work in war plant office and drafting room.*

ASK YOUR  HOUSE ABOUT  
LIGHTING EQUIPMENT BY **WAKEFIELD**



LET'S S-T-R-E-T-C-H

OUR RESOURCES...

*Electrically*

# S-T-R-E-T-C-H YOUR FUSE "MILEAGE"

**This Free Book Shows How  
to Reduce Electrical Outages . . .**



## PARTIAL LIST OF CONTENTS

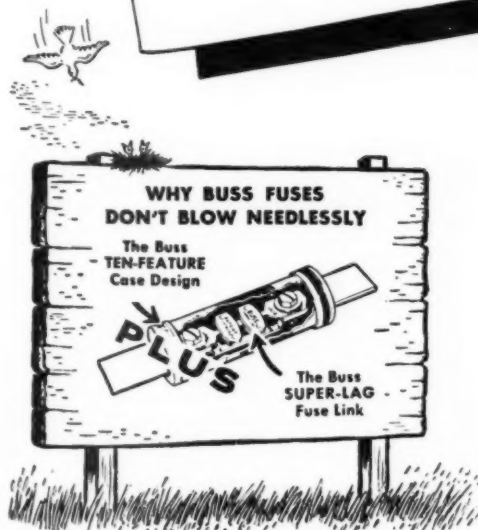
- What to do when fuses blow
- Where to look for trouble that caused fuses to blow
- What to do after you have found the trouble
- How to select right type fuses for various circuits
- How to determine proper size fuse or Fusetron to use for different applications
- How you can save material and cut costs on motor installations
- How to recognize a reliable make of fuses
- and
- a lot of other useful information that will help you get more service out of your fuses.

## SAVE FUSES

**. . . Send for Your Copy  
of This Book**

**BUSSMANN MFG. CO.**

Division McGraw Electric Company  
University at Jefferson, St. Louis



**MOBILIZED AT THE POINT OF NEED...**





# Installation Goes Like Clockwork

when you put in  
"Skilled Lighting"  
Fixtures by Wheeler!



You can avoid time-wasting troubles on your lighting jobs by selecting quality fixtures... equipment designed and built with the skill and integrity that come only through long years of specialized manufacturing experience.

Wheeler Fixtures are "skilled lighting" that will never let you down! They're made by lighting specialists with over 60 years' experience... designed for speedy, trouble-free installation... engineered for maximum lighting efficiency... accurately and sturdily constructed to meet top standards of materials and workmanship. They'll help you get prompt inspector-approval on your jobs... save you later servicing.

All your requirements can be supplied by Wheeler's complete line of Industrial Fixtures. Wheeler engineers will be glad to work with you in planning the right layouts. Write for latest catalogs of Wheeler Incandescent and Fluorescent Fixtures. Wheeler Reflector Co., 275 Congress St., Boston, Mass., . . New York . . Cleveland. Representatives in principal cities.

DISTRIBUTED EXCLUSIVELY THROUGH ELECTRICAL WHOLESALERS

## Wheeler

### REFLECTOR COMPANY

LIGHTING EQUIPMENT SPECIALISTS SINCE 1881

#### TYPICAL WHEELER FIXTURES



##### RLM Duratach Units

Made in Dome, Angle and all other standard types. Wheeler Duratach construction provides for quick and easy interchangeability of reflectors.



##### RLM Open-End Fluorescent Units

Made in two or three-lamp constructions, units can be mounted from chain, conduit, or directly to ceiling. For use with 48-inch, 40-watt lamps. RLM units for use with 100-watt lamps also available.

##### Wheeler Vapor-Tight Fixtures



Made in all standard pendant and ceiling types. Designed to resist deteriorating effects of vaporous and atmospheric conditions.



##### Class II-G Dust-Tight Units

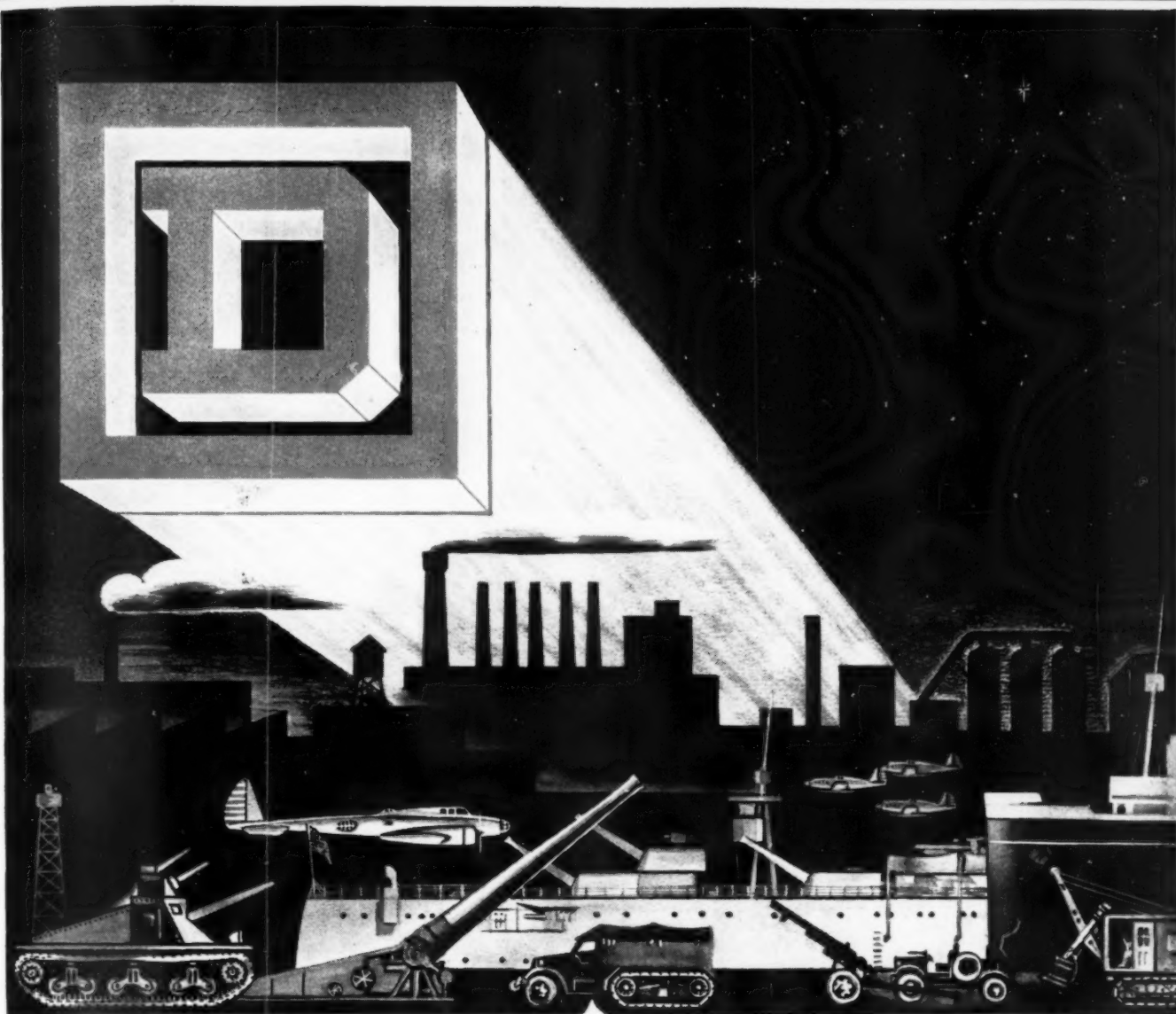
Approved for "Class II-G" hazardous locations. Hinged glass cover protects lamps, sockets and reflecting surfaces. Available for use with two or three 48-inch, 40-watt Fluorescent lamps.



LET'S S-T-R-E-T-C-H

OUR RESOURCES...

*Electrically*



From everyone's standpoint, we consider it fortunate that Square D is meeting its sizable wartime production assignments with STANDARD equipment, distributed and installed through its regular peace-time channels. ★ Through its 550 distributors, Square D affords fast local deliveries, up-to-the-minute priority information, planning and installation counsel. In short, the method of distribution which has served both Square D and its customers so well in the past, is doubly effective during these days of "all-out" production effort.

**SQUARE D COMPANY ★ DETROIT ★ MILWAUKEE ★ LOS ANGELES**

KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK

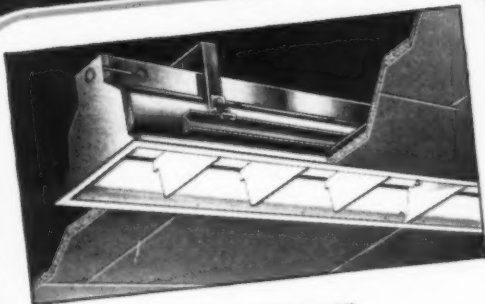
IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

**MOBILIZED AT THE POINT OF NEED...**

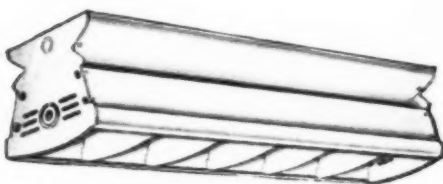


The DAY-LINE . . .  
UNIT and CONTINUOUS  
for industrial installations—  
singly, in parallel batteries,  
or in long, continuous un-  
broken lines. Removable  
non-metallic reflectors

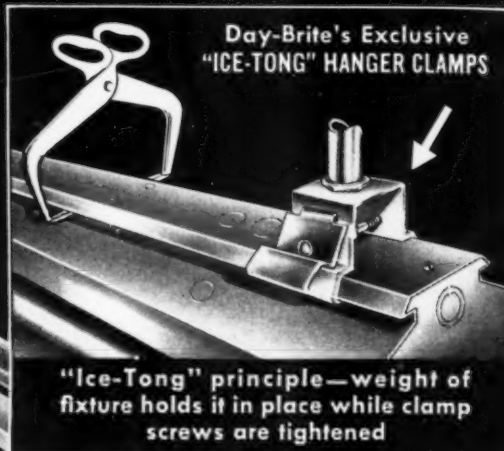
**NEW**  
FLUORESCENT FIXTURES



**The RECESSED TROFFER**  
With non-metallic reflectors and louvers—  
for unit and continuous run installations



**The LITEWAY**  
Exposed troffer, with non-metallic sides,  
top and louvers—for direct ceiling mount-  
ing in single units or long continuous runs



Day-Brite's Exclusive  
"ICE-TONG" HANGER CLAMPS  
"Ice-Tong" principle—weight of  
fixture holds it in place while clamp  
screws are tightened

## THE VICTORY SERIES WITH Non-Metallic Reflectors

THERE ARE THREE FEATURES that distinguish  
the fixtures comprising the Day-Brite Victory Series:  
(1) Day-Brite Super-White baked enamel assures high  
reflection values and longer life; (2) Speed in installa-  
tion, and ease of servicing, are achieved through sim-  
plified mechanical design; (3) Truss-like construction  
assures maximum rigidity of the entire installation...  
Bulletins on request.

**DAY-BRITE LIGHTING, INC.**  
5443 Bulwer Ave., St. Louis, Mo.



Patent Nos. 2,281,346, 130,740  
Other Patents Applied For

**Day Brite**  
Reg. U. S. Pat. Off.  
**FLUORESCENT  
FIXTURES**

The COMPLETE LINE OF FLUORESCENT LIGHTING FIXTURES



LET'S S-T-R-E-T-C-H

OUR RESOURCES...

*Electrically*

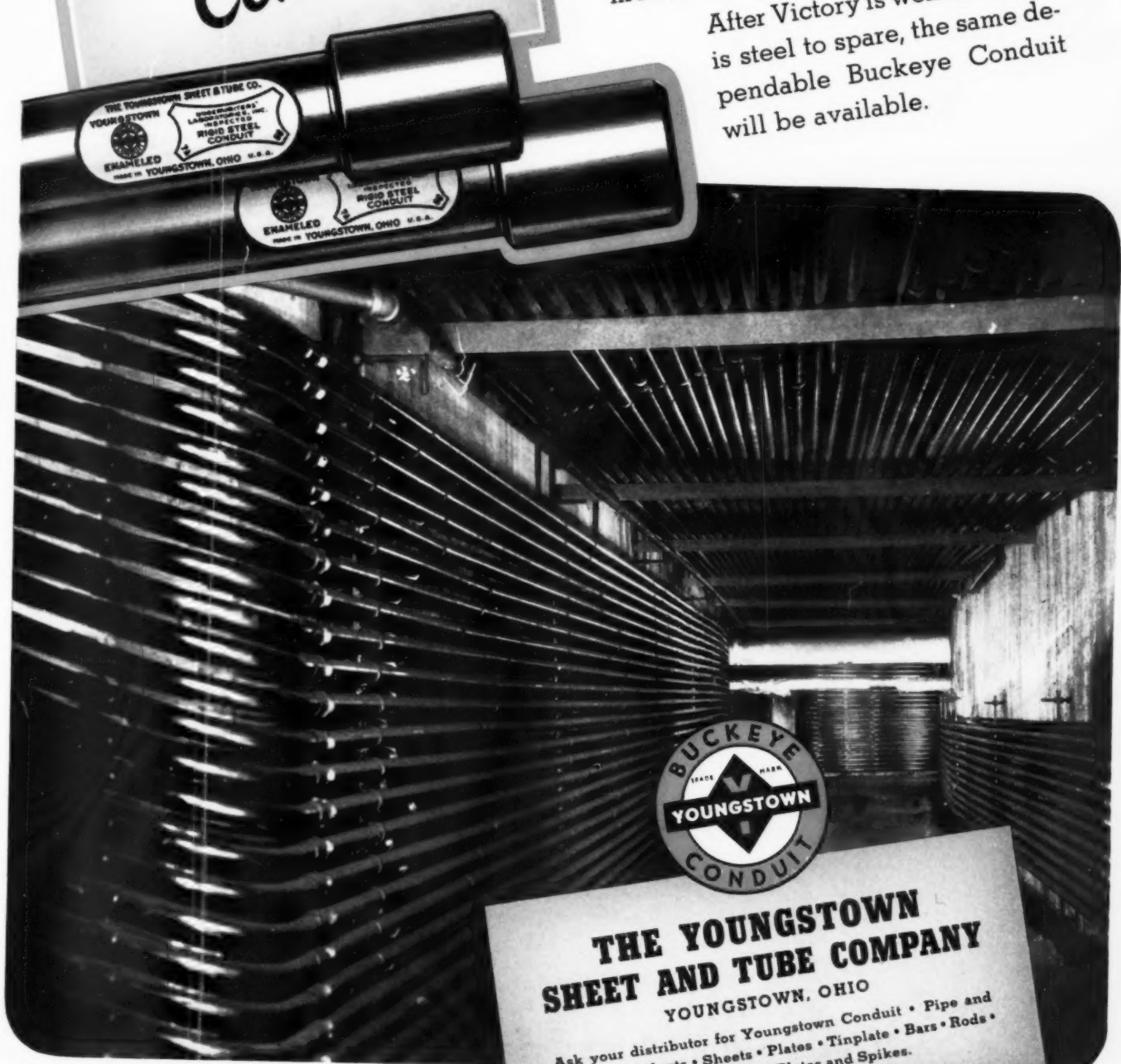


Where Wiring Needs  
REAL PROTECTION  
THE ANSWER IS STILL

*Buckeye  
Conduit*

**W**AR denies the use of rigid steel conduit for all except most vital needs. If your need qualifies you for it, you will find war-time Buckeye Conduit the same dependable product—insuring permanent protection to vital electrical wiring. But if war bids you say goodbye to Buckeye for the duration, remember this:

After Victory is won and there is steel to spare, the same dependable Buckeye Conduit will be available.



**THE YOUNGSTOWN  
SHEET AND TUBE COMPANY**  
YOUNGSTOWN, OHIO

Ask your distributor for Youngstown Conduit • Pipe and  
Tubular Products • Sheets • Plates • Tinplate • Bars • Rods •  
Wire • Nails • Tie Plates and Spikes.

26-22E

**MOBILIZED AT THE POINT OF NEED...**



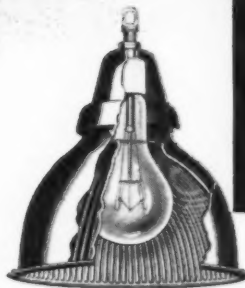
For the JOB  
THAT CAN'T  
GO WRONG



No. 589 Reflector Unit with vibration proof holder.



No. 589-T Reflector Unit with cast metal bottom ring and tripod holder.



No. 1589 Reflector Unit with metal housing.



### THE NEW CURTIS NO. 589-R REFLECTOR

provides the ideal means of lighting those important wartime lighting jobs that must be laid out in a hurry but which just can't go wrong.

The No. 589-R reflector is a large wattage unit, for use with 500, 1000, or 1500 watt lamp (or 400 watt mercury lamp), but its size and consequently its price is moderate.

Distribution is unusually smooth and even permitting greater freedom in application, and its coefficient of utilization is exceptionally high so that it may be applied with little wasted light. Three reflector units incorporating this reflector are offered. Each has its particular advantages, which one you will use depends on the conditions to be met. See illustrations.

No. 589-R is a genuine X-Ray Silver Mirror Reflector. X-Ray Reflectors have been the recognized standard of quality for over 40 years. They are easy to maintain, are not subject to deterioration, and use few critical materials.

You can't go wrong if you specify X-Ray Reflectors. Write today for full information on these new units.

# CURTIS LIGHTING, INC.

6135 W. 65TH STREET.....CHICAGO



LET'S S-T-R-E-T-C-H

OUR RESOURCES...

*Electrically*

# NO COMPROMISE WITH QUALITY

## Jefferson Electric Products Meet War Production Requirements

● Since practically all installations today are in connection with vital War Production—the quality and reliability of Jefferson Electric Transformers, Ballasts, and Fuses for the protection of electric equipment and circuits, are of more than usual importance.



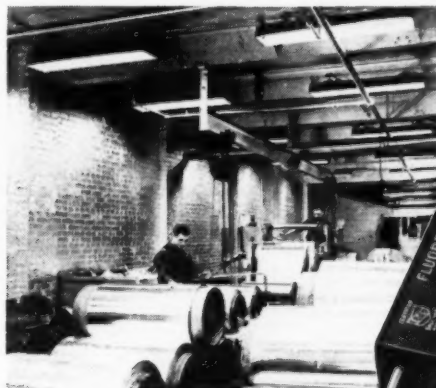
● There is no compromise with quality at Jefferson—stress of the present emergency has not changed the traditional thoroughness of engineering and craftsmanship. It will pay you to specify "Jefferson Electric" to insure performance and maximum results.



### JEFFERSON TRANSFORMERS

FOR MERCURY LAMPS

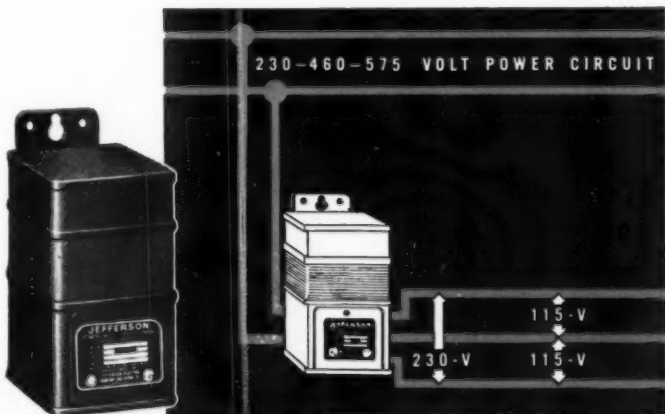
Correctly designed to provide the necessary current through the starting and operating cycles of mercury lamps, Jefferson Transformers more than meet the most exacting requirements. To be sure of maximum lighting performance—specify Jefferson Transformers.



### JEFFERSON BALLASTS

FOR FLUORESCENT LAMPS

24-hour production demands the best in fluorescent lighting—and the best in Ballasts. It is significant that so large a majority of important lamp manufacturers, engineers and contractors insist on long-life Jefferson Electric Ballasts.



Eliminate duplicate high and low voltage circuits—distribute only the 230 to 575 volt service—and provide the 115 volt current where needed for lamps, small tools and appliances by means of Jefferson Electric dry type Power Circuit Transformers.

### JEFFERSON POWER CIRCUIT TRANSFORMERS

### TO PREVENT SERIOUS DAMAGE TO ELECTRIC MOTORS AND EQUIPMENT

Proper fusing eliminates unnecessary shutdowns and damage to motors, wiring and equipment. Delays interfere with all-out production.

Jefferson Renewable Fuses provide the safe, reliable protection required. When excessive overloads require these fuses to open the circuit, they do it safely. Their rugged construction and simple design permit quick cleaning and easy renewal.



### JEFFERSON RENEWABLE UNION FUSES SUPER-LAG

JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago) Illinois

MOBILIZED AT THE POINT OF NEED...





# APPLETON UNILETS AND CONDUIT FITTINGS

## *Save Time. Cut Maintenance to the Bone!*

### COMPLETE LINE MEETS EVERY SPECIFICATION

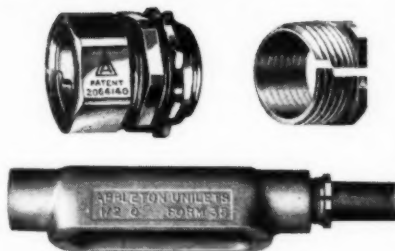
#### FOR EXAMPLE

Appleton Malleable "Unilets" in widest possible range of types and sizes. Threaded and No-Thread—for Heavy or Thin-Wall Conduit.



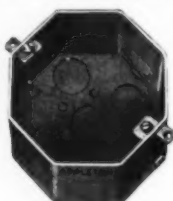
#### FOR EXAMPLE

Thin-Wall Couplings and Connectors—and patented, quick adapters which enable you to use standard threaded fittings with Thin-Wall Conduit.



#### FOR EXAMPLE

Octagon and Square Outlet Boxes—Switch Boxes—Special Pull Boxes, lengths 12 to 72 inches, hub sizes, 1 to 6 inches.



#### FOR EXAMPLE

Couplings, Connectors, Clamps and Clamp-Backs for Rigid Conduit—Fixture Hangers for Every Need.



The name "Appleton," the registered trademark, "Unilets," or the famous circle-A Appleton trade-mark shown above, appears on every Appleton fitting. We manufacture no private brand goods!

You can save precious time on rush war construction jobs by specifying APPLETON "Unilets" and other conduit fittings! The big, complete Appleton line includes every type and size needed for every job—all expertly-designed, with rugged quality carefully controlled in Appleton's own foundries and fabricating plants.

You build for permanence, in two ways, when you install Appleton fittings—they last as long as the building, reducing maintenance costs to the minimum, and they enhance your reputation as a reliable contractor.

For prompt, dependable service on priority-rated orders, specify Appleton fittings, the recognized Standard for Better Wiring!

Sold Through Wholesalers

**APPLETON ELECTRIC COMPANY**  
1704 WELLINGTON AVENUE CHICAGO, ILLINOIS

Branch Offices: NEW YORK, 76 Ninth Avenue • DETROIT, 7310 Woodward Avenue • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Mission Street • ST. LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 North Santa Fe Avenue • ATLANTA, 203 Luckie Street, N.W. • BIRMINGHAM, 6 N. Twenty-First Street • MINNEAPOLIS, 305 Fifth Street, S. • PITTSBURGH, 418 Bonar Avenue

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# A P P L E T O N



LET'S S-T-R-E-T-C-H

OUR RESOURCES...

*Electrically*

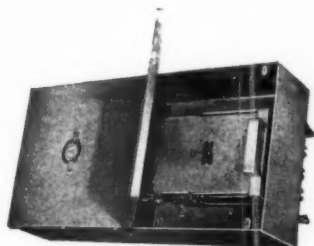
## CONNECT...



### MACHINES IN A MATTER OF MINUTES

Flex-A-Plugs, with "stab" connections to buses, simply plug into Flex-A-Power runs at intervals of 12" or more.

## CORRECT...



### POWER FACTOR AT POINT OF LOAD

Capacitor Flex-A-Plugs combining protective and disconnect devices with G. E. Pyranol capacitors, correct power factor where it should be corrected, right at the machine.

## PROTECT...



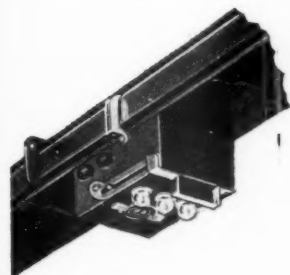
### WITH FUSED SWITCHES RATED IN HORSEPOWER OR CIRCUIT BREAKERS

Type "F. E." Flex-A-Plugs have Trumbull Type "AT" Automatic Circuit Breaker Mechanism providing automatic over current and short circuit protection.

Type "F. D." plugs contain Type "RBA" heavy duty motor circuit safety switch mechanism.

Type "F. L." plugs with cam operated cover have double break switch mechanism with fuses accessible only when fully disconnected.

## INDICATE...



### PHASE FAILURE IMMEDIATELY

Neutralizer Flex-A-Plugs, installed at ends of branch circuits, protect against voltage build-up in secondary and give instant visual indication of phase failure.

*It's all  
in the plugs*



## FLEX-A-PLUGS

*complete the* **TRUMBULL**

### ENCLOSED BUSBAR DISTRIBUTION SYSTEM

Every day new war-plant installations re-emphasize the savings in TIME and VITAL MATERIAL made possible by the Trumbull Enclosed Busbar Distribution System... using quickly installed, standardized, prefabricated sections for main and branch power feeders.

FULL benefits of this system, however, are dependent upon the wide variety and unique engineering features of the Trumbull FLEX-A-PLUGS that permit immediate connection or disconnection of motor driven machines at any point (12" centers) on the line.

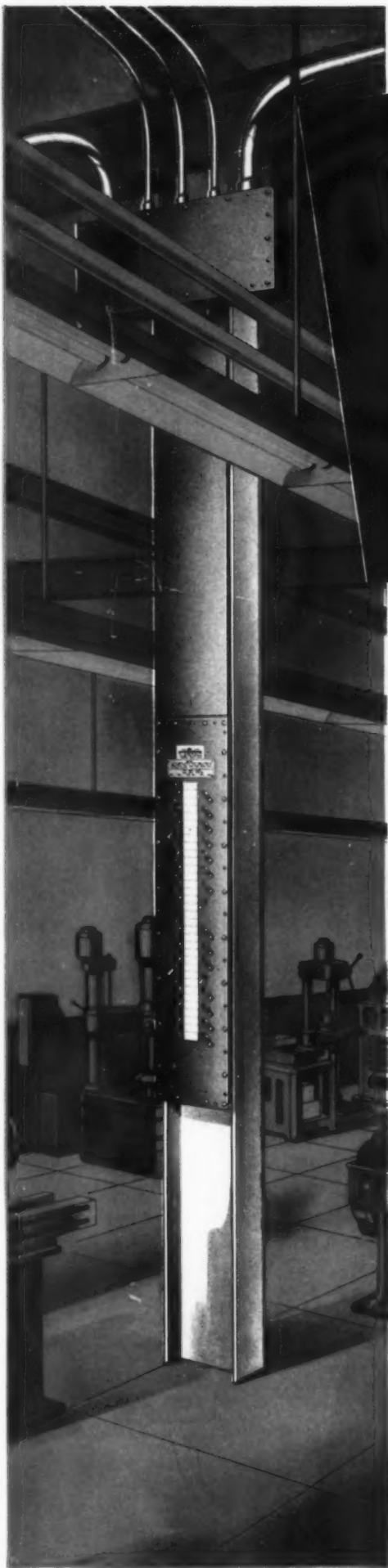
Take the New Capacitor Plug, for example. Here, for the first time, is a simple and practical means for correcting unsatisfactory power factor conditions *right at the point of load*. Capacitor Plugs, combining G. E. Pyranol capacitors with switching or circuit breaker disconnects in a single unit, can be plugged into any Flex-A-Power outlet. Correctly rated power factor correction units can be distributed throughout the system in approximately the same manner as the load, and can be relocated as load conditions change, thus achieving maximum benefits.

Other FLEX-A-PLUGS are briefly described in the column at the left. For detailed information, write for TRUMBULLAID bulletin 408.



**MOBILIZED AT THE POINT OF NEED...**





# Dust-laden atmospheres spell **DANGER!**

Every safe-guard must be used to prevent arcs that might set off explosions. Therefore many plants have installed

## **FA DUST-TIGHT PANELBOARDS**

as a precautionary measure . . . Underwriters' Laboratories, Inc., have approved these panelboards for "Class II, Groups F and G, Hazardous Locations," covering atmospheres containing carbon black, coal or coke dust and grain dust . . . They are ideal safety equipment in shell-loading plants, coal mines, coal processing plants, grain mills and other plants troubled with dust-laden atmospheres.

Instead of the usual steel front, consisting of trim and door, this panelboard has a solid steel front plate, gasketed all 'round, and secured with screws to the extra wide flange. It is further rendered dust-tight with welded hubs for conduit outlets, welded box-corners, and handle bushings riveted directly to the steel cover plate. The brackets are welded at the back.

The circuits are externally operable by a mechanism of new FA design. The handles operate through the dust-tight bushings, and engage the regular handles on the circuit breakers inside the cabinet. ON and OFF positions are indicated on the front of the cabinet.

The FA Dust-tight Panelboard may be had in standard type, or in narrow column type (as illustrated). It is of the circuit breaker type, with either FA Type AC or FA Dublbrak circuit breakers, or other types of lighting branch-circuit circuit breakers . . . Capacities: 50 Amperes or less, for 3 wire, single phase, or 4 wire, 3 phase mains, with lugs only. Available with 4 to 42 circuits . . . Frank Adam Electric Company, St. Louis, Missouri.



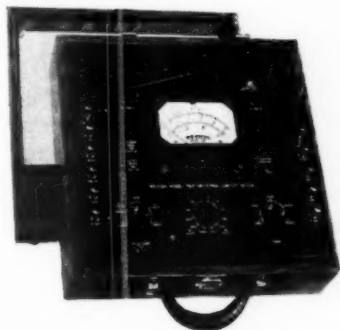
LET'S S-T-R-E-T-C-H OUR RESOURCES... *Electrically*





### Weston Model 633 A-C CLAMP AMMETER

—a real *time-saver*, which tests without disturbing circuits or interrupting work. The clamping jaws are simply placed over the conductor or switch blade for current reading.



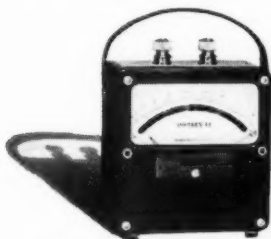
### Weston Model 785 INDUSTRIAL CIRCUIT TESTER

A highly versatile tester for trouble shooting. Provides voltage, current and resistance ranges for checking motor and control circuits, lighting circuits, sensitive relay circuits, electronic circuits, etc. (D-C sensitivity 20,000 ohms per volt.)



Industry's production figures bear testimony to the outstanding contribution electrical contractors and plant maintenance men are making to war-plant efficiency. Despite obstacles such as materials scarcities and limited manpower, electrical equipment—old and new—is being kept constantly fit for full scale output.

As part of the efficient maintenance combat team the WESTON test instruments illustrated—and others—are playing an important role. For in addition to their *trustworthy indications* on which maintenance has long learned to depend—they also provide features which greatly simplify preventative maintenance procedure. *In less time—at far lower cost*—industry's electrical equipment is being kept *fit* with dependable WESTONS.



### Weston Model 430 TEST INSTRUMENTS

The universal favorites for active maintenance . . . compact, rugged and with enduring precision. Large scale openings with hand calibrated mirror scales assure quick, accurate readings. Available in A-C and D-C instruments and single phase wattmeters.



### Weston Model 703 DIRECT READING ILLUMINATION METER

—measures all types of lighting direct, without correction factors—fluorescent, mercury vapor, incandescent, neon, daylight, etc. Made in models and ranges for shop and laboratory needs.

Weston Electrical Instrument Corporation, 672 Frelinghuysen Avenue, Newark, New Jersey

MOBILIZED AT THE POINT OF NEED...



# Firms like these find that **GraybaR**

## **HELPS S-T-R-E-T-C-H THEIR RESOURCES** for wartime service to you

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Appleton Electric Company

Benjamin Electric Mfg.  
Company

BullDog Electric Products Co.

The Bryant Electric Company

Bussmann Mfg. Co.

Curtis Lighting, Inc.

DayBrite Lighting, Inc.

The Fibre Conduit Company

Harvey Hubbell, Inc.

Ilg Electric Ventilating Co.

Jefferson Electric Company

National Electric Products  
Corporation

Simplex Wire & Cable Co.

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Steel & Tubes, Inc.

The Thomas & Betts Co., Inc.

The Trumbull Electric Mfg. Co.

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Webster Electric Company

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Corporation

Wheeler Reflector Company

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**Planning and installation aid . . .**



**Simplified purchasing and billing routine . . .**



**Centralized responsibility for products that  
go together in use . . .**



**Emergency service to keep war plants pro-  
ducing by rallying vital supplies . . .**



# GraybaR

**IN OVER 80 PRINCIPAL CITIES**

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# Motor Shops

## RACK FOR SHEET INSULATION

An all welded steel "T" and angle iron rack for full sized and partial sheets of insulating paper and fibre is another addition to the shop equipment of the



**REDUCED WASTE** of insulating paper in this motor shop results from the use of orderly stacking and "odds and ends" shelves adjacent to standard sheet racks.

Wiley-Wray Electric Co., Cincinnati, Ohio.

The rack, designed and built in the shop, is 75-in. high; 41-in. deep and 50-in. overall width, including the cantilever arms for roll paper. The shelves are made of  $\frac{3}{4}$ -in. wood shelving which rest on the angle iron flanges.

There are seven shelves, each 29-in. wide for the full-sized sheets. Each shelf has a 19-in. inclined extension which holds odd and cut pieces of the insulation. The shop rules call for clearing the shelf extensions of all usable odds and ends before a new sheet is taken. The 34-inch overhanging arms support four rolls of different types of insulation.

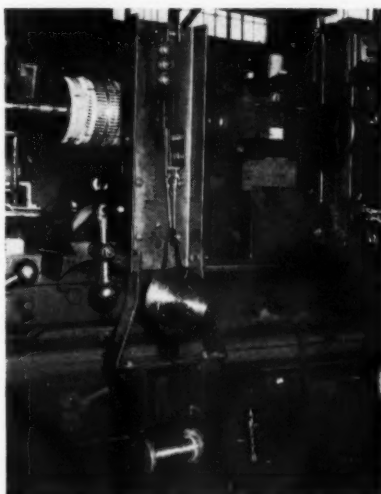
This bit of good housekeeping saves steps, lost time fumbling for small pieces of sheet insulation and expedites the use of odds and ends.

## INDICATING TENSION DEVICE

Mechanics in the motor repair shop of the Tri-State Armature and Electrical Works, Inc., Memphis, Tenn., are able to determine wire tension while banding armatures.

An indicating tension device is mounted on the tool carriage of an old lathe that has been converted to a banding machine. The unit includes a 25-inch length of 8-in. by 2-in. channel iron equipped with a flat-iron stirrup and brackets for holding the banding wire spool, a scale and tension blocks.

The scale has two pointers, one of which can be set to the required tension; the other indicating the actual tension on the wire. The bottom of the scale is attached to the metal stirrup; the top to a simple tension block through which the banding wire passes. For larger armatures the heavier banding wire is threaded through additional tension spools at the top of the channel. The spacing of these spools regulates the tension—the closer together they

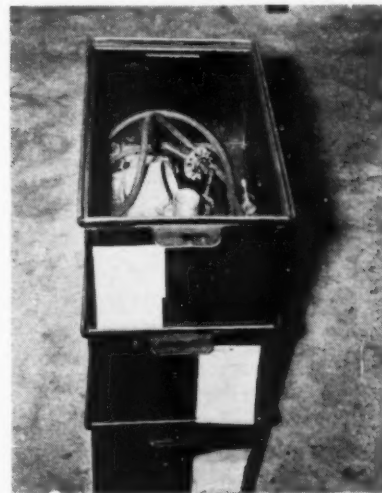


**WIRE TENSION** can be read on scale of this banding wire tension device. When scale pointer nears pre-set pointer the desired tension is on the wire. Entire unit is mounted on tool carriage of banding lathe.

are, the greater the tension. The wire then passes over a small grooved roller to the rotating armature.

## TOTE BOXES

Tote boxes are a necessary part of the shop equipment of the Jay Electric Co. motor repair specialists of Detroit, Michigan. They are used to keep all parts of small motors and electric tools together as they go through the repair



**NO LOST PARTS** of electric tools or small motors in this shop. All parts are kept together in these tote boxes as they journey through the repair department. Increased shop efficiency results from this type of job control.

department. And when you consider that this shop handled as many as 100 electric tools per day during the heyday of the automobile industry, you can picture the efficiency, resulting from this job procedure. Work benches are always clear of the numerous small parts. None go astray, hence no time is lost looking for them.

The boxes are made of sheet steel and are 20-in. long, 12-in. wide and 9-in. deep. Two protruding grips, welded on each end, facilitate carrying. An offset flange around the top of the box permits easy and safe stacking of the units. Job orders and instructions are clipped to the outer side of the boxes.

## SPRING ACTION ON UNDERCUTTER

Instead of taking an armature to the undercutting machine, they take the undercutter to an armature on any lathe in the motor repair shop of Roland Electric Co., Baltimore, Md. The entire undercutter assembly fits the tool car-



## TIME-SAVING FEATURES OF J-M TRANSITE DUCTS -- NO. 1



Harrington Couplings are installed cold... need no special skill to form tight joints... assure correct alignment. A complete line of bends, sweeps and special fittings is available.

There's no lost motion assembling Transite Ducts. Harrington Couplings eliminate screwing or threading... go together quickly... drive up tight.

Transite's smooth, slick bore means rapid cable pulls. Because Transite Ducts are light in weight, they are easily handled. And on the job, their asbestos-cement composition assures complete fire-safety, unusual resistance to corrosion.

For details, write for brochure DS-410. Johns-Manville, 22 East 40th Street, New York, N. Y.



**ON EXPOSED LOCATIONS,** Transite Ducts assure permanently low maintenance. Their asbestos-cement composition is unusually resistant to weather, smoke and fumes.

**Johns-Manville**  
**TRANSITE DUCTS**

**TRANSITE CONDUIT**... for exposed work and for installation underground without concrete encasement.

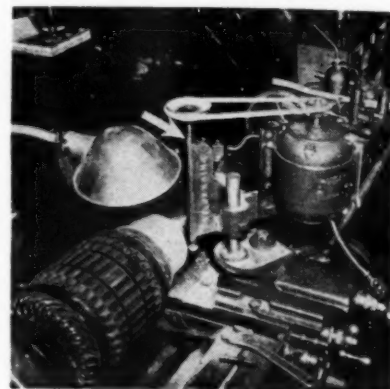
**TRANSITE KORDUCT**... for installation in concrete. Thinner walled, lower priced, but otherwise identical with Transite Conduit.



[FROM PAGE 79]

riage of the lathe and can be mounted in place in a jiffy.

One feature of this particular piece of equipment is the vertical shafted, spring-controlled cutting tool that is belt driven by a  $\frac{1}{2}$  hp., 1725 rpm., single phase, 110 volt motor. This spring on the shaft permits this cutter to follow the irregularities of the commutator slots without



**SPRING CONTROL** on vertical shaft (arrow) of undercutter, permits cutting disk to follow slot irregularities without cutting copper bars. Entire undercutter assembly mounts on tool carriage of lathe and can be moved from lathe to lathe.

cutting the copper bars. Both horizontal and vertical adjustments can be made on the unit.

The undercutter is moved along the commutator slot by moving the tool carriage on the lathe. The depth of the slot to be cut is also controlled by adjustments on the tool carriage.



**CIVIL WAR LATHE**, once used to turn cannon barrels, is still operating at the Tri-State Armature and Electrical Works, Inc., motor repair shop, Memphis, Tenn. It has been converted into an armature banding machine and is doing its part in repairing motors to help our industrial front win its all-out effort for Victory in World War II.



## VARIABLE SPEED ROTATION TEST

Considerable time and labor are saved in the motor shop of the Jay Electric Co., Detroit, Mich., by testing connections in multi-winding, variable speed stators before the motor is completely assembled.

The test embodies the use of a small dummy squirrel cage rotor and a stand-



**ROTATION TEST** with speed control and dummy rotor is made to determine if all windings in this 2 hp. 3-phase, 4-speed squirrel cage motor give proper direction of rotation. Motor is then assembled for final test.

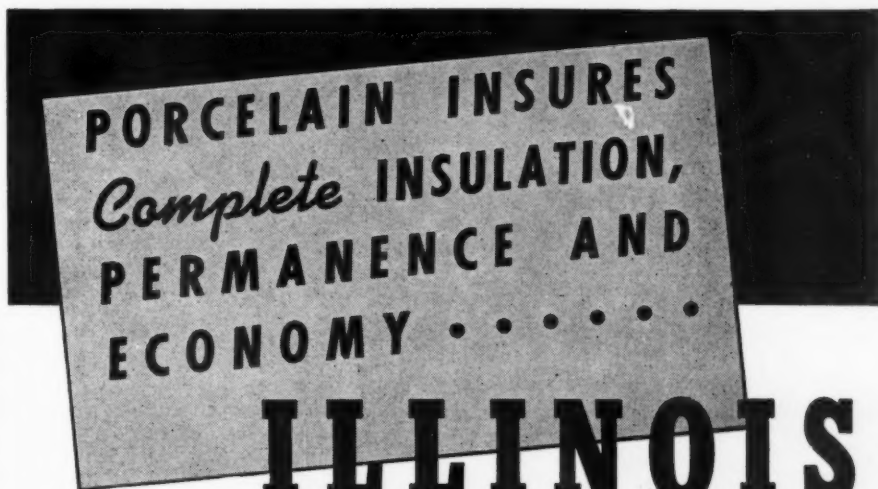
ard speed controller, connected to the motor windings and the line voltage direct from the test board. By operating the controller and observing the dummy rotor held in the stator, speed variations and rotation can be detected. Thus, direction of rotation of all speed ranges can be checked before motor is assembled and final test is made.

## SUSPENDED PARTS JARS

Small motor parts and accessories are "canned" in half-pint glass jars over the assembly bench at the Tennessee Electric Motor Service shop in Nashville, Tenn.

Approximately 150 of these ordinary fruit jars are suspended in three staggered rows from two by four's along the bench length. The screw caps of the jars are securely fastened to the underside of the wood supports.

A healthy twist of the wrist disengages a labeled jar from its supporting cap. Once the necessary parts are removed the jar can again be screwed into its cap. Thus jars are not shunted about, but are put back in the correct place—the empty screw cap.



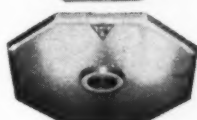
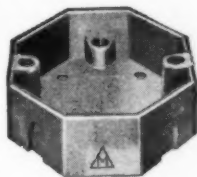
## Completely Insulated ALL PORCELAIN WIRING SYSTEMS

• Look into porcelain advantages now for the important jobs that you are going to do. See how the Illinois Electric Porcelain Company has made each of its products to be most adaptable and practical—easy to handle—easy to install.

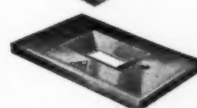
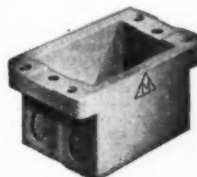
Porcelain is a logical wiring material and it conserves steel, zinc, copper, rubber. Grounding is unnecessary when you use this system. Clamps are not required for porcelain boxes.

You get every advantage in making easier, safer, more convenient, and efficient layouts. Rusting and corrosion problems are eliminated.

Being a non-critical material, you can make your plans for the use of ILLINOIS Porcelain now.



OUTLET BOXES AND  
COVERS



SWITCH BOXES  
AND COVERS



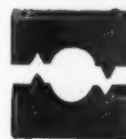
TOGGLE SWITCH  
PLATES



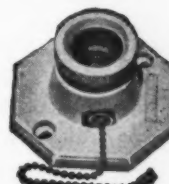
STANDARD TUBES



STANDARD KNOBS



CLEATS



LAMP HOLDERS

**ILLINOIS ELECTRIC PORCELAIN CO.**  
MACOMB, ILLINOIS

# WHAT!! Beat the Axis with REFLECTORS?

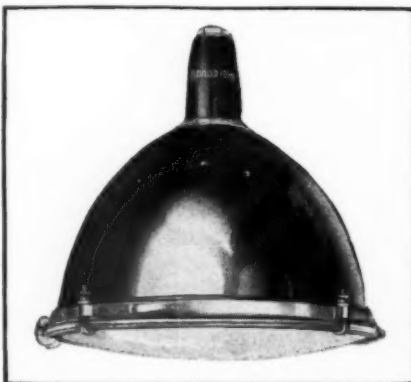


**O**F COURSE, it takes planes, tanks, and guns to win a war. But in the plants that make these things, light is considered the important factor in speeding eyes and hands, reducing errors, assisting precision workmanship. Hence, reflectors are playing a vital role in helping to defeat the Axis.

To get more weapons to our fighting men faster, new Goodrich developments in industrial lighting help keep war production at top speed with such modern fixtures as the Highlite Reflector. This high mounting porcelain enameled fixture provides abundant illumination for large industrial interiors without glare or shadow to interfere with comfortable vision. Catalog sheets on request.



Protecting vital plants with floodlighting—saving man-hours in production—Goodrich Industrial Fixtures are serving America's war effort everywhere.



Goodrich Highlite Reflector

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OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 4602 BELLE PLAINE AVENUE, CHICAGO, ILL.

*Motor Shops*

[FROM PAGE 81]

Small screws, nuts and other accessories are kept in cup-cake tins on the bench shelf. Under this shelf are a row



*WITHIN ARM'S REACH* of the mechanics, yet out of the way, are these rows of suspended small parts jars on this motor shop assembly bench. Parts are always "where needed—when needed."

of bins for the larger accessories. Arrangements of this type provide for maximum working areas on the benches and makes for a clean orderly shop.

## FLAT COPPER BENDER

A special forming vise for flat copper used in slip ring rotor coils has been designed and built at the Tri-State Armature and Electrical Works, Inc., Memphis, Tenn. motor service shop.

Used exclusively for flat copper, it



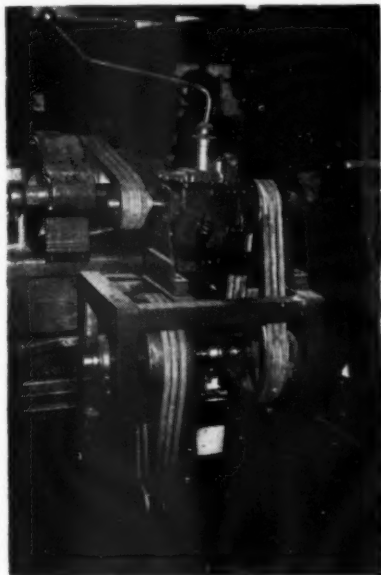
*ROTOR BARS* of flat copper (arrow) are offset in this rotor coil shaper. Handy adjustments permit varying degrees of offset and long lever reduces fatigue.

consists of a rectangular frame of 1-inch square steel bar bolted to an I-beam base. The frame is 24-in. long and 5½-in. high. The lever operated copper vise rides on two 11-inch guide bars mounted perpendicular to the main frame. The 8-inch vise jaws are tightened by a threaded bolt arrangement. An adjustable grip on the main frame holds the nose of the coil. Adjustment of the grip plus a stop collar on the vise guide rails determines the degree of offset in the rotor bars.

The entire unit is mounted to a bench in the taping department, so formed bars can easily be insulated.

## GEAR SHIFT LATHE DRIVE

Speed variations from 10 to 900 r.p.m. are obtainable on this motorized lathe at Anderson's, Inc., Nashville, Tenn. motor service shop. The speeds are derived from a combination of the lathe



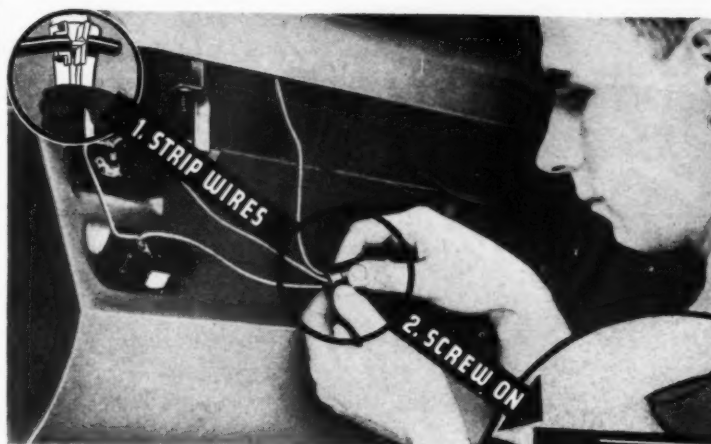
*VARIABLE SPEEDS through an automobile transmission, friction clutch, V-belt motorized drive increase the usefulness of this motor shop lathe.*

gears and an ordinary Ford transmission through a V to flat belt drive and a friction clutch.

The motorized drive is comprised of a 1 hp., 1800 r.p.m., 3-phase motor driving (V to flat belt) a friction clutch and countershaft which, in turn, drives the transmission unit. The lathe cone pulley is connected by a flat-to-V belt drive to the transmission.

Reverse speeds can be obtained through the transmission and by electrically reversing the rotation of the driving motor.

The gear shift control offers an exceptionally convenient and flexible means of quickly selecting appropriate speeds for all types of winding jobs.



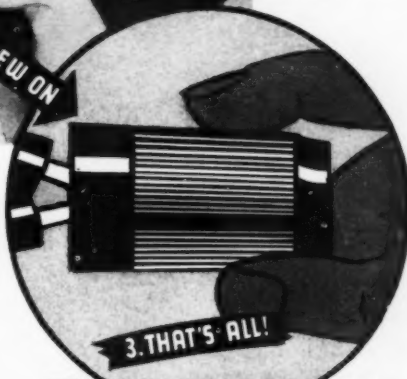
### LEFT

On Fixture Installations and Repairs, "Wire-Nuts" save valuable time.

### BELOW

"Wire Nuts" occupy very little space; especially suited for work in close quarters.

# SPEED WIRE JOINTS



## ... AND CONSERVE CRITICAL MATERIALS!

"WIRE-NUTS" are available now! No delays—speed up the wiring of War Plants and homes. And save "critical" war materials—Lead, Tin and Rubber, as required for solder-and-tape joints. Time-saving "Wire-Nuts" bring you more contracts—more profits.

"WIRE-NUT" joints are better electrically—safe, prevent shorts at wire joints; stronger mechanically—withstand several times the pull of the best soldered joint.

"WIRE-NUTS" make a neat, craftsmanlike job that passes inspection quickly.

**MILLIONS IN USE**—Thousands of electrical contractors have standardized on "Wire-Nuts"—FULLY APPROVED. Listed by Underwriters' Laboratories, Inc.

**SIZES FOR EVERY JOB**—For everything from small conduit fittings up to sizes large enough to join 3 No. 10 wires. WRITE FOR FREE SAMPLES, NOW!



Solderless, Tapeless Wire Connectors

Other IDEAL War-Time Wiring Job-Speeders

- Fish Tape Reel and Puller
- Wire Strippers
- Joist Borers
- B-X Armor Cutter
- Cable Ripper
- Switch Box Supports

**SOLD THROUGH JOBBERS**

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Sales Offices in All Principal Cities



# Questions ON THE Code

Answered by  
**F. N. M. SQUIRES**

Chief Inspector New York Board of Fire Underwriters

## ARMORED CABLE

**Q.** "The Government has shut down on the use of BX cable but permits the use of non-metallic sheath cable. Can this be run on the surface of walls and ceilings and can we omit outlet boxes and use plates at outlets? I don't see any rule about this in Article 336 except Section 3368 which says that outlet devices of insulating materials may be used without boxes on exposed cable wiring."—M.C.

**A.** Section 3361 states that non-metallic wiring jobs shall comply with, among others, Section 3014 and Section 3014 requires the use of boxes at all outlets except as provided in Section 3368, where an outlet device of insulating material and as described in 3368 is provided.

This writer has not seen such an outlet device although there may be some made. Unless such a device is available an outlet box to which the fixture may be attached must be installed.

Of course the outlet box can be of insulating material and does not have to be of metal.

## WIRE ASSEMBLIES

**Q.** (1) What are wire assemblies as mentioned in rules 2556a and 2558b?—L.M.

**A.** (1) A wire assembly is any group of wires run together in close proximity. It may be a group of wires run together in conduit, electric metallic tubing, raceway, cable (either armored or non-metallic sheathed or service cable, etc.). A cable assembly, as mentioned in 3071 and 3072, is a group of wires made into a cable.

**Q.** (2) Do outlet boxes on knob and tube or non-metallic sheathed cable, ever have to be grounded? If so, what rule requires it?—L.M.

**A.** (2) Metal outlet boxes on knob and tube wiring or non-metallic sheathed cable, would have to be grounded

if (2542b) located in a wet location and not isolated (by location),  
if (2542c) in a hazardous location,  
if (2542d) in electrical contact with metal or metal lath, or  
if (2542e) equipment operates at over 150 volts to ground.

Section 4527 further strengthens the requirements of 2542d.



**TIME OUT** for a breather is taken by Eric Nylund, Nylund Electric Co., Duluth, Minn. Eric has been kept busy on an Ordnance Plant job at Baraboo, Wis., and is keeping his weather eye open for more like this one.

## A GROUP OF MOTORS

**Q.** I have the problem of installing five small motors on a single machine on which the available space for switches and protection devices is very limited. The motors are all 3 phase, 220 volts and the current ratings add up to 5.3 amperes. These motors are all manually operated and under the constant control of the operator of the machine and do not always all operate at the same time.

Can I use a three pole fused safety 30 ampere switch as the disconnect switch and the 15 ampere fuses as the protection and use two pole toggle switches with thermal units as the individual motor controls? The toggle switches would always be used to start and stop each individual motor and the thermal unit on each switch would be rated at 125 per cent of the rating of the motor which it protects. Is the above in accordance with Code requirements?—L.D.

**A.** The scheme as outlined meets the Code requirements. As the total horsepower of the five motors is less than two and the total ampere rating is 5.3 amperes, the safety switch acting as the disconnect switch must be at least 15 amp. capacity to satisfy 4410 and 4402b.

This safety switch as it complies with Section 4407, could then serve as both the disconnect and the controller for this group of motors but as all of the motors do not operate together, a separate control for each motor is desirable. These controllers may be the toggle switches mentioned and may be two pole for the three phase motors (see section 4384).

The thermal units mentioned by our correspondent are to be recommended and should be selected with a rating of not over 125 percent of the individual motor rating. These units being in only two of the phase legs, comply with Section 4327.

## TWO SWITCHES FOR MOTORS

**Q.** "Why, on motor work, do we need to install two horsepower rated switches in series with each other? Why isn't one switch enough when it is of proper rating?"—P.H.

**A.** Two identical horsepower rated switches would not be required by the Code.

The Code, in Section 4381, requires that each motor has a controller, and, in Section 4401, specifies that each motor has a disconnecting means.

Section 4382 to 4390 give the speci-

I'M NEARLY THROUGH ALREADY—YOU KNOW IT TAKES ONLY A JIFFY TO PLUG IN THE BREAKER

YES, THAT SURE IS A NEAT ARRANGEMENT—YOU HAVEN'T HELD US UP AT ALL



## Here's Why This New Removable Breaker Is So Easy to Install

**H**ERE'S a breaker that sets a new record for quick installation. With the case bolted in place, it's easy to connect the cables—there's plenty of room to work. And then it takes but a moment to plug in the breaker unit, which has contacts that readily engage those in the case.

This new removable breaker saves valuable time when in service, too. In fact, it's called the *3-minute breaker*, because, with it, you can re-establish service after temporary faults in less than one minute;

inspect the breaker in safety—away from live parts—in less than *two* minutes; and where load conditions have changed, you can interchange breaker units in less than *three* minutes.

Install these new AE-1 breaker units in lighting, power, and motor circuits. They will protect both the circuit wiring and the apparatus connected to the circuit. They will guard against the prolonged delays and the damage often caused when less adequate protective devices are subjected to severe short circuits.

A new illustrated booklet (GEA-3600) tells how and shows where to use these breakers. For a copy, write the G-E office near you, or address *General Electric Co., Schenectady, N. Y.*

THE BREAKER WITH THE DISCONNECT FEATURE

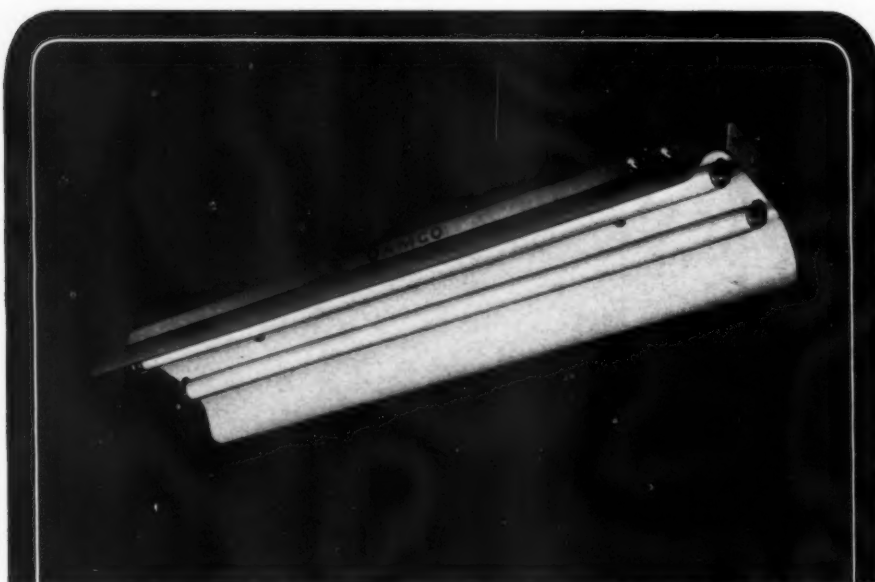
**GENERAL  ELECTRIC**

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KEEP THE POWER ON YOUR MACHINES  
WITH G-E AIR CIRCUIT BREAKERS







## WAR PRODUCTION LIGHTING *saves metal . . . gives more light!*

The new OAMCO Non-Metallic Fluorescent Fixtures for Industrial Lighting are made to conform to the simplified designs of the National Bureau of Standards.

The reflectors are made of a rigid non-metallic material and treated with two coats of glossy white, chip-proof enamel that gives them a reflection factor of 85%. Baked at 300° F., they have a tough hard surface that will not discolor and is easy to keep clean.

Furnished in DOUBLE 40, TRIPLE 40 and DOUBLE 100 units, OAMCO Non-Metallic Fluorescents are adaptable to 110-125, 220-250 volt industrial installations and may be mounted by either the Jack-Chain, Direct to Conduit or End to End method. Write to-day for complete information on this new War Production Line!



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**OVERBAGH & AYRES MFG. CO.**  
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411 SOUTH CLINTON STREET • CHICAGO

### Questions OF THE Code

[FROM PAGE 84]

fications which controllers must meet and Sections 4401 to 4410 covers the disconnecting means.

But to directly answer the question of our inquirer we refer to Section 4407 and find that only one switch is necessary and that it may serve as both a controller and a disconnecting means if it meets with certain requirements. These requirements are:—that for a motor above two horsepower up to 50-hp. it must be rated in horsepower, that it must open all ungrounded conductors, that it must be protected by an overcurrent device and is one of the following types: an air break switch directly manually operable, a circuit breaker directly manually operable, or an oil switch.

The need for a disconnecting means ahead of a controller not meeting all of the above requirements is to insure a manual means of opening a motor circuit in case of the failure of a motor controller to properly operate and also to provide a means of cutting all the current off of a controller in order to do work on the controller or on the motor.

### ALLOWANCE FOR APPLIANCE LOAD

**Q.** "We understand that in figuring the light and power load in multi-family dwellings where the laundering and ironing will all be done outside of the apartment in a "community



**MARINE WIRING** is rapidly becoming the specialty of Gordon Adams (left) and Chad Johnson of the engineering department, Arrowhead Electric Co., electrical contractors of Duluth, Minn. Arrowhead is now concentrating its talents on the wiring of ships for Uncle Sam's war effort.



laundry", and where the floor area of a single apartment is less than 1000 square feet, the small appliance load may be taken at 1000 watts instead of 1500 watts. Is this so?"—R.A.

**A.** Section 2108, paragraph C, requires that a small appliance load of 1500 watts be taken for "individual apartments of multi-family dwellings having provisions for cooking by tenants". This, then, requires including in the computation 1500 watts per appliance when the apartment has a kitchen or kitchenette or other provisions for cooking meals.

Of course where there are no provisions for cooking and the area is less than 1000 square feet the allowance can be 1000 watts.

## OFFICIAL INTERPRETATIONS

by the

Electrical Committee of the N.F.P.A.

### Interpretation No. 227

**STATEMENT:** A small building is used exclusively for housing gasoline, Diesel fuel oil and kerosene pumps. Such buildings are frequently found in the very near vicinity of large storage tanks as the bulk and wholesale plants of oil companies.

**QUESTION:** Should such a building, so located, be considered as a Class I, Group D hazardous location?

**ANSWER:** Section 5001 contemplates that the authority enforcing the code shall determine when a particular premises or installation of apparatus conforms to the code description of a hazardous location. Generally speaking, close proximity to a bulk station warrants classification of an electrical equipment as in a hazardous location. Not all pump houses need be so classified. The final responsibility for classification rests with the enforcing authority.

### Interpretation No. 228

**QUESTION 1:** Does paragraph (d) of section 2583 of the 1940 edition of the National Electrical Code require a separation of at least 6 feet between grounding electrodes even though the electrodes are bonded together?

**ANSWER:** Yes.

**QUESTION 2:** If metal frames and cases of electrical equipment are bonded together, as specified in section 2546, is the 6-foot separation between grounding electrodes for a lighting rod and a common grounding electrode of the electrical system necessary?

**ANSWER:** Yes.

# FEDERAL



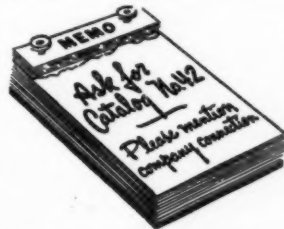
## THE NEW FEDERAL CATALOG

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This new 68 page, illustrated 2-color catalog is designed to provide a quick, ready reference to help you in the selection of the proper switch or panelboard or circuit breaker for every use.

You will find it a valuable source book. For it contains a complete listing of specifications and list prices of the Federal line plus a wealth of useful additional information—Allowable Increased Horsepower Rating, Number of Conductors in Conduit, Wiring Data for Motors. And you will find in it a simplified numerical cross-index to make comparisons easy.



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latest literature of leading manufac-  
turers without cost or obligation.

## LIGHTING EQUIPMENT

**1** Bulletin F-60 illustrates and describes fluorescent industrial lighting equipment for both single unit and continuous installations. Day-Brite Lighting, Inc.

## INSTRUMENTS

**2** Catalog 4220, consisting of 12 pages, features direct and alternating current indicating instruments for mounting on switchboards. Roller-Smith Company.

## DISTRIBUTION SYSTEM

**3** Circular 337 illustrates and describes new features of the L.V.D. (low voltage drop) enclosed bus-bar distribution system. The Trumbull Electric Mfg. Company.

## HANDBOOK ON MOTORS

**4** A new handbook entitled "A Guide to Wartime Care of Electric Motors". It is for war plant engineers and maintenance men and of particular value for training new men. Alis-Chalmers Mfg. Co.

## BALLASTS

**5** Bulletin 421-FL contains latest information on single, two-lamp and three-lamp ballasts for fluorescent lamps. Complete specifications, dimensions and wiring diagrams are included. Jefferson Electric Co.

## LIGHTING EQUIPMENT

**6** Catalog 42, consisting of 88 pages, illustrates and describes fluorescent and incandescent lighting equipment for industrial and commercial use. Curtis Lighting, Inc.

## MOTOR DRIVE

**7** Booklet B-3045 describes a modern sectional motor drive for paper machines. Features of the drive are enumerated and operating advantages listed. Westinghouse Electric & Mfg. Co.

## BALANCING MACHINES

**8** A folder of bulletins featuring dynamic balancing machines for precision balancing of rotating parts. Bear Manufacturing Co.

## CONDENSERS

**9** A new catalog listing essential condensers, resistors and test instruments for wartime use. It also includes motor-starting replacement capacitor listings. Aerovox Corp.

## FLUORESCENT LIGHTING

**10** A 34-page catalog giving the story of the development of Zeon cold cathode fluorescent lighting. It includes illustrations and descriptions of many installations. Federal Electric Company, Inc.

## WIRE DATA

**11** A wall chart, approximately 36 inches high by 21 inches wide, consists of three tables on basic and frequently used wire data. Callite Tungsten Corp.

## FLUORESCENT LIGHTING

**12** An 8-page folder entitled "What you should know about Fluorescent Lighting." It illustrates and describes industrial and commercial units. Fluor-A-Beam, Inc.

## CAPACITOR WELD UNITS

**13** Bulletin No. 1300, describing the new "Revera-O-Charge" capacitor weld units. It explains operation and gives schematic diagram of the new condenser discharge circuit. Weltronic Corporation.

## SIGNALING DEVICES

**14** Bulletin No. 480, consisting of 16 pages, covers Navy type and commercial equivalent annunciators, bells, buzzers, contact makers, horns, sirens and thermostats for all kinds of maritime requirements. Edwards and Company, Inc.

## FLUORESCENT LIGHTING FIXTURES

**15** A new fluorescent lighting catalog giving technical specifications, list of recommended minimum standards of illumination, pictures of actual applications and general engineering and maintenance information. Sylvania Electric Products, Inc.  
[Continued on Page 90]

Circle numbers, sign and paste on your letterhead and mail in an envelope.

### ELECTRICAL CONTRACTING

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October

(Not good after December 1)

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31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65										

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# RIBBONS OF DEFENSE

Piercing the privacy of night, giant "eyes" watch over our cities. As the silver ribbons of light reach and reveal the plane, anti-aircraft guns automatically have it covered. These guardians of our homes are controlled by a nervous system of wires—wires that *must not fail*. Should the gun's concussion break a single insulation, the defense of the city must falter.



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Fortunately, prior to the war, a revolutionary kind of insulated wire was developed and perfected by United States Rubber Company. Millions of feet of this Laytex® Wire are fighting with our Armed Forces and serving in the fire and police commu-

nications systems of our cities. It is used in the lighting of modern buildings. Laytex is thin, light, strong, tough. This rubber insulation is the most flexible of all insulation for electrical conductors. It is most impervious to moisture and remains stable through

a wide range of temperatures. It will not shatter under concussion. This is a vital factor in its use by both the Army and Navy. It is perfectly centered—because, for the first time in the history of electricity, the insulation is applied successfully in liquid form.

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WIRES AND  
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★ ★ ★ **A**DEQUATE protection of vital war production against delays or shutdowns due to accident or sabotage is an important consideration today. The hazards of lightning should not be overlooked. Lightning is Nature's method of making an air raid, can act like either an incendiary bomb or a demolition bomb. Yet West Dodd can provide security easily and at reasonable cost.

West Dodd Lightning Protection and static control installations are widely used on Army Ordnance Plants. They are helping safeguard ammunition loading lines, standard magazines, underground magazines and bag loading buildings. Many important industrial plants have equipped their power stacks with West Dodd Protection.

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West Dodd represents a consolidation of the 12 old line manufacturers of lightning protection. Including the famous Dodd & Struthers Company, pioneer of modern lightning protection equipment and certified methods of installation. This wealth of experience in designing, building and installing lightning protection, plus a long-proved record of responsibility, are plus factors in choosing West Dodd for the job.

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OR  
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TODAY!

**WEST DODD**  
LIGHTNING CONDUCTOR CORP.  
GOSHEN, INDIANA

New  
Literature

[FROM PAGE 88]

DATA BOOK

**16** A new 178-page book, B-2161-B, is designed to give architects and engineers application, specification, and price estimating information on electrical equipment, including motors of all sizes, control, switchgear, transformers, protective devices, circuit breakers, no-fuse load centers, panelboards, household equipment and mechanical equipment. Westinghouse Electric & Mfg. Co.

INSTRUMENT

**17** A four page folder illustrating and describing Model ESD high sensitivity electro-static voltmeters. Herman H. Sticht Company, Inc.

DISTRIBUTION SYSTEM

**18** Booklet B-3120 describes a power distribution system for industrial plants. The new network system combines flexibility, reliability and voltages regulation. It can be extended by adding additional units. Westinghouse Electric & Mfg. Co.

V-BELTS

**19** A new handbook entitled "Plain Facts on Wartime Care of Rubber V-belts". It gives the entire V-belt maintenance story. Allis-Chalmers.

INSTRUMENTS

**20** A new 12 page catalog 4120, describing this line of 3- and 4-inch panel instruments. Dimensions and mounting details on all standard-panel instruments are shown. Roller-Smith Company.

FLUORESCENT LIGHTING

**21** Bulletins illustrating and describing this line of industrial and commercial fluorescent lighting fixtures. R & W Wiley, Inc.

MOTORS

**22** Bulletin GEA-3684A describes and illustrates Type KSP, unit-bearing, shaded-pole, fractional horsepower fan motors. General Electric Co.

CIRCUIT BREAKER

**23** Catalog 2150 describes low-voltage air circuit breakers designed for use on alternating current circuits up to 600 volts and direct current circuits of 250 or 750 volts. Roller-Smith Company.

PULLEYS

**24** Bulletin CP-42 features both solid and split conveyor pulleys and contains data needed to specify conveyor pulleys in either crown or straight face construction. Types of pulley construction and lagging, sizes, list prices are included. American Pulley Company.

#### SWITCHES

**25** A new four-page bulletin illustrating and describing improved G-E circuit control switches for industrial applications. They are for use in signalling equipment, communication apparatus, instrument panelboards, utility lighting systems, specialized lighting equipment, etc. General Electric Co.

#### CONNECTORS

**26** A pocket catalog featuring drawings and illustrations of 75 electrical connector types with their when, where and how-to-use features. Burndy Engineering Co., Inc.

#### MICROPHONES

**27** A new catalog designed to aid in the proper selection of microphones for various war and vital civilian applications. Shure Brothers.

#### BLACKOUT CONTROL

**28** Bulletin No. 25 illustrates and describes blackout control for stores, night lights, signs, street lights, large buildings, store windows, etc. The Hart Mfg. Co.

#### LIGHTING EQUIPMENT

**29** A four page folder featuring industrial and commercial fluorescent lighting fixtures. Richter-Metalcraft Corp.

#### ELECTRIC PRODUCTS

**30** A new condensed catalog 426 lists data on distribution systems, safety switches, service equipment, Kbl-duct, lighting panels, switchboards and circuit breaker panels. Bull Dog Electric Products Co.

#### CONTROL CENTERS

**31** Bulletin 411, consisting of 20 pages, describes and illustrates this entire line of control centers, including motor control centers and switchboard control centers. The Trumbull Electric Mfg. Co.

#### SERVICE EQUIPMENT & SWITCHES

**32** Bulletin 1000 covers fusible service equipment and meter entrance switches for use in defense housing plans, government housing projects and war workers' homes. A similar bulletin 4000, covering circuit breaker and multibreaker entrance equipment is also available. Square D Company.

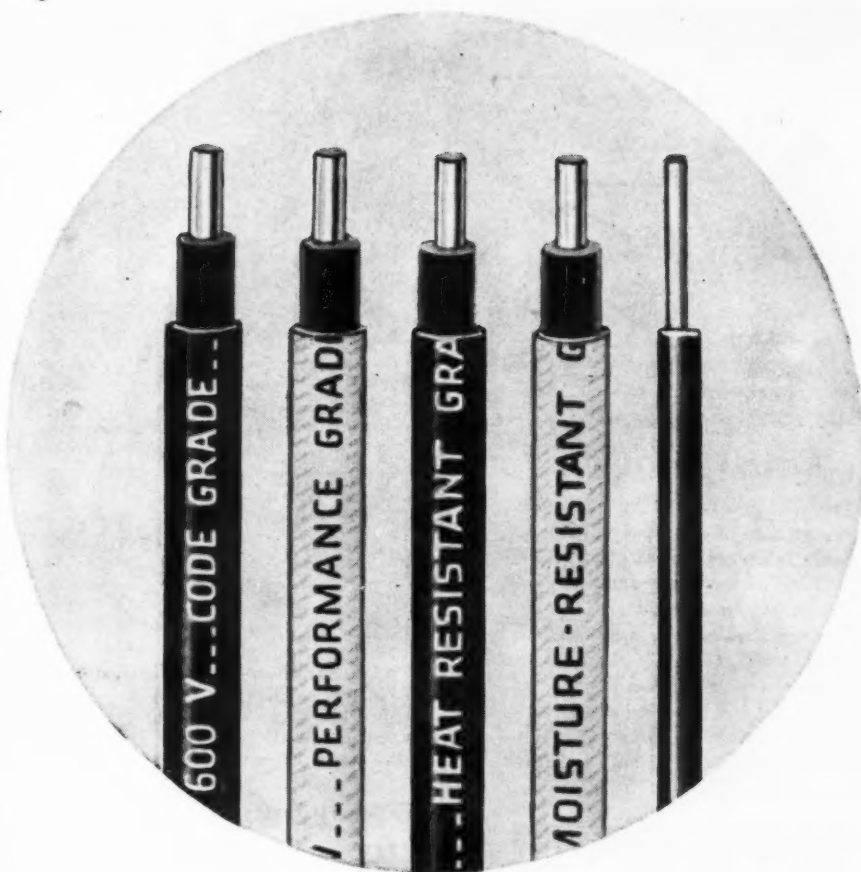
#### VARNISH

**33** A folder outlining the advances made in the insulating varnish field. John C. Dolph Company.

#### MOTOR CONTROL

**34** A booklet on electric motor control for school workshops. In addition to information on overload and undervoltage protection and manual control, it includes a typical shop layout showing full magnetic control. Cutler-Hammer, Inc.

[Continued on Page 92]



## G-E Quality BUILDING WIRES

**Easy Stripping, Clean Stripping, Easy Pulling**

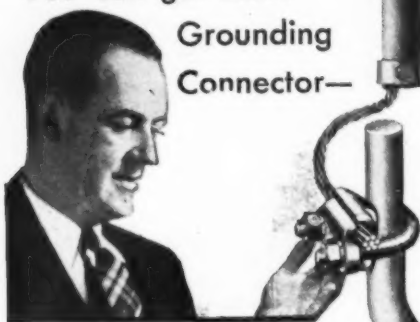
You'll like the uniform high quality of G-E Building Wires. It makes installation easy and helps to assure long dependable service. The best raw materials are used. Manufacturing is carefully done.

*This wire is ideal for use on war projects.* Five grades of insulation are available for different requirements: Type R, Code grade; Type RP, Performance grade; Type RH, Heat Resistant grade; Type RW, Moisture Resistant grade and Type SN Synthetic Insulated. The grade of insulation is shown on the surface of the wires.

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Grounding  
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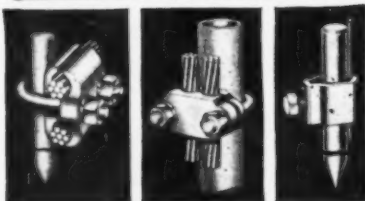


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Write us for any grounding connector, clamp or stud . . . for all combinations of pipe, rod, flat bar, cable, braid, tubing.

Every one a *dependable* unit of protection for personnel and equipment . . . of ample capacity, high mechanical strength, and resistant to corrosion.



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ELECTRIC CORPORATION**  
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## Literature New

[FROM PAGE 91]

### INSTRUMENT

**35** A four-page folder, Bulletin No. 760, featuring Model "J" hand tachometer, a triple-range instrument. Herman H. Sticht Company, Inc.

### INSULATION

**36** Sections C and D of Catalog No. 13. Section C is devoted to Fibreglas electrical insulation and Section D covers Pedigree insulating varnishes and insulating compounds. Insulation Manufacturers Corporation.

### TRANSFORMERS

**37** Bulletin No. A-10 is a four page folder illustrating and describing the dry type transformers. Newark Transformer Co.

### INDUSTRIAL FIXTURES

**38** Bulletin F-61 illustrates and describes the new "V-Series" Day-Line industrial fluorescent lighting fixtures with non-metallic reflectors. Day-Brite Lighting, Inc.

### SWITCHGEAR

**39** Bulletin GEA-3850 describes and illustrates metal-enclosed switchgear for heavy-duty direct current service up to 250 volts, 8000 amperes. General Electric Co.

### MACHINING

**40** This booklet gives the general principles of machining aluminum and its alloys. Part 1 deals with general machine shop practice. Part 2 describes the practices employed in automatic screw machine operations. Aluminum Company of America.

### WIRING

**41** Bulletin No. 425, consisting of 24 pages, features Trol-E-Duct, a prefabricated busway wiring method providing highly flexible lighting. In addition to description, many installation pictures are shown. Bull Dog Electric Products Co.

### TRANSFORMERS

**42** Bulletin 421-PCT describes the uses of dry-type power circuit transformers and circuit diagrams shows how electrical installations for lighting and power can be simplified. Jefferson Electric Co.

### INSTRUMENTS

**43** Bulletin No. 126 outlines the new RCP instruments for laboratory and production use. Radio City Products Co., Inc.

### RELAYS AND CONTACTORS

**44** A four page folder illustrating and describing alternating or direct current relays and alternating current contactors. Automatic Electric Manufacturing Co.

## FLUORESCENT ACCESSORIES

**45** A new 16-page catalog on G-E fluorescent accessories and an insert on the new manual reset master no blink starter. It contains general and technical information on fluorescent lighting principles. General Electric Co.

## MACHINE TOOL ACCESSORIES

**46** An eight page folder featuring live centers, metal etcher, demagnetizer, grinding wheel dresser, balancing ways, variable speed pulleys, electric marker and portable cleaners. Ideal Commutator Dresser Co.

## ELECTRONIC TUBES

**47** A quick-selection and comprehensive chart of electronic tubes for industry, with technical data on applications and tubes. General Electric Co.

## LIGHTING EQUIPMENT

**48** A 12-page booklet dealing with the practical application of fluorescent and incandescent lighting to industrial plants. Many installation pictures are shown. Bright Light Reflector Company.

## MOTORS

**49** A four page folder, Bulletin No. TEF-1, illustrating and describing totally enclosed fan cooled, built in steel, power sealed, motors. The Torq Electric Manufacturing Co.

## PROTECTIVE LIGHTING

**50** Bulletin No. LMB-4231 consists of 12 pages of data on protective lighting equipment. Mounting and spacing heights are given. Line Material Company.

## CLIPS AND TERMINALS

**51** A four page folder illustrating and describing the new Beryllium copper fuse clips and screw terminals. Littelfuse, Incorporated.

## FLUORESCENT LUMINAIRES

**52** A new catalog describing and illustrating this line of industrial and commercial fluorescent lighting fixtures. Martin-Gibson Light & Tile Corp.

## CONSERVATION

**53** A booklet entitled "It's the Little Things that Count" points out the importance today of conserving even the most minor office supplies. Allis-Chalmers Mfg. Co.

## LAMP LOCK

**54** A folder featuring Flur-O-Locks, to lock fluorescent lamps against vibration difficulties. Laduby Company.

## INSTRUMENT

**55** Bulletin No. 780 illustrates and describes Model "C" hand tachometers. Herman H. Sticht Company, Inc.



## CAPACITORS

**56** A 6-page folder on Dykanol capacitors for power factor improvement. Indoor and outdoor type capacitors are described and illustrated. Cornell-Dubilier Electric Corp.

## ALARM SYSTEMS

**57** Bulletins featuring electric eye burglar alarm systems for industrial and central office systems for protection against intrusion, sabotage, and burglary. Photobell Corporation.

## DISTRIBUTION EQUIPMENT

**58** A 40-page manual on this line of telephone protection and distribution equipment. Cook Electric Company.

## SWITCH

**59** A folder illustrating and describing the new heavy duty Snap-Lock control station switch. It also covers limit switches, solenoids, line voltage switch. The National Acme Co.

## STARTERS

**60** A 16-page bulletin describing this line of automatic reduced voltage starters. It discusses the factors that enter into the selection of automatic reduced voltage starters for squirrel cage motors. Allen-Bradley Company.

## CABLE RACKS

**61** Bulletin C-S-50 features the new M. & W. non-inductive type cable racks for a.c. or d.c. current. Illustrations and table of dimensions are given. The M. & W. Electric Manufacturing Co., Inc.

## FLUORESCENT UNITS

**62** Catalog No. FL-5 and price list FL5-CI covers "V" type cover fluorescent units and Line-O-Lamps for industrial plant buildings, factory offices, engineering department, inspection departments. The Wiremold Company.

## VENTILATION

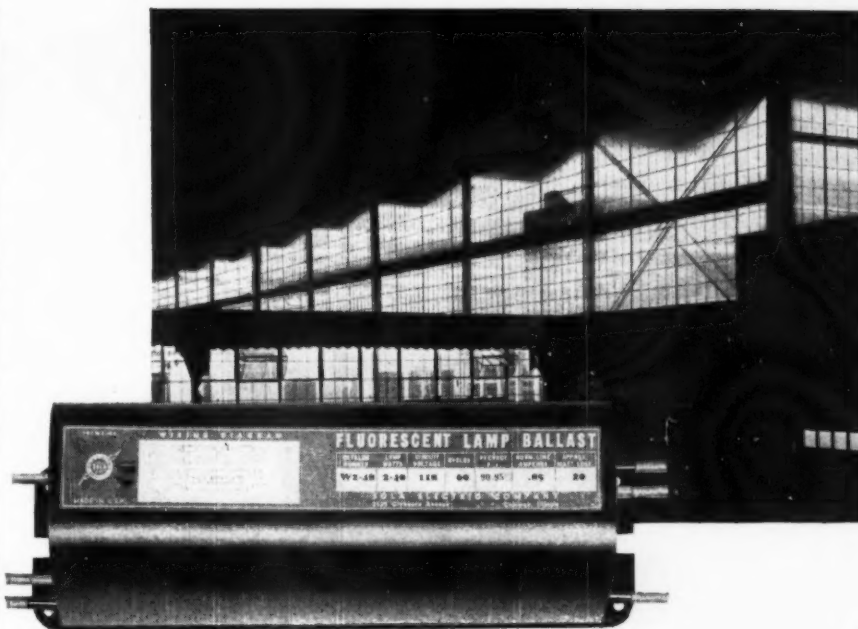
**63** The title of this new bulletin is "Blackout your Windows but Not your Ventilation". It features a typical solution which has been engineered on the West Coast. Ilg Electric Ventilating Co.

## COLD-CATHODE STANDARDS

**64** This bulletin deals with "Cold-Cathode Lamp Type Designations", covering standard tubes as regards straight and curved lamps, positioning of electrodes, length, tube diameter and "white" color. Fluorescent Lighting Association.

## ELECTRICAL EQUIPMENT

**65** A 68 page catalog containing engineering data on safety switches, panelboards, circuit breakers, etc. Also photographs and complete specifications; wiring data for motors; number of conductors in conduit. Federal Electric Products Co.



# Fluorescent Ballasts

FOR PLANTS WHERE WAR PRODUCTION  
IS GEARED TO THE HIGHEST EFFICIENCY

We designed this rugged little giant to enable you to match the efficiency of your lighting system with the high efficiency at which your production lines are turning out vital materials of war. It's your first line of defense against faulty operation or breakdowns in your plant lighting system even where the going is tough.

This new unit—W2-48—is designed to conform to the latest E. T. L. recommendations for proper lamp performance. Every unit is tested under actual lamp operating conditions and guaranteed against defective materials or faulty workmanship. Noise and hum are very definitely under control.

Specify W2-48 for ballast replacements—the mounting centers are interchangeable.

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It's very, very  
quiet . . .



Listen! . . . Noise and hum in the new W2-48 are very definitely under control.

Every W2-48 is tested under actual lamp operating conditions and guaranteed against defective materials or faulty workmanship.

for tough jobs, specify  
W2-48

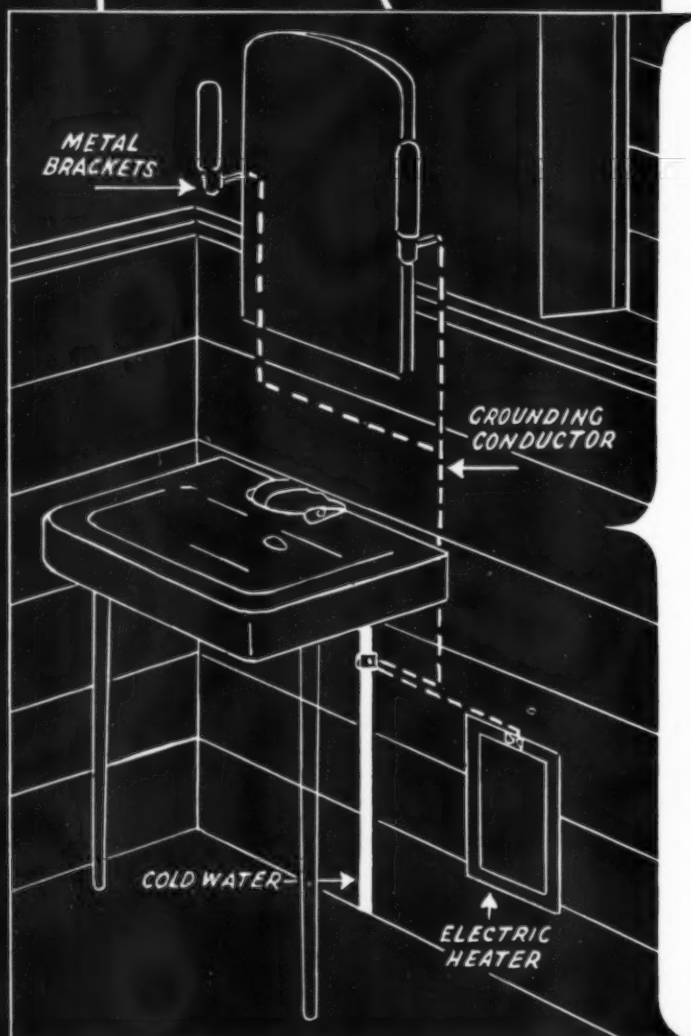
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## MODERN PORCELAIN PROTECTED WIRING SYSTEMS

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**METAL FIXTURES  
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GROUNDED**

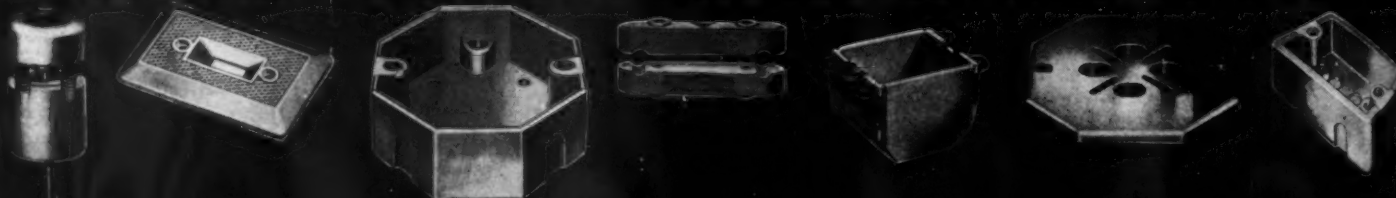


On Porcelain Protected Wiring Systems, all devices and fixtures in bathrooms, laundries, kitchens, and similar areas may be porcelain or housed within porcelain enclosures, effectively eliminating shock hazards and assuring the highest degree of safety. It is generally recommended that porcelain protection be provided on all exposed parts of the electrical system within reach in such areas.

In areas where metal enclosed fixtures or appliances must be used adjacent to plumbing fixtures, it is often desirable to ground the metal canopy or fixture to prevent a shock hazard in case of insulation failure within the fixture or appliance. When such metal enclosed fixture or appliances are installed, however, porcelain protected wiring systems offer a grounding method independent of the current carrying conductors which provide complete protection.

Modern Porcelain Protected Wiring Systems offer the safest inherent shock hazard protection. In bathrooms, kitchens, and basements, use porcelain protected fixtures and devices. Grounding where needed in a Modern Porcelain Protected Wiring System is a carefully installed electrical circuit designed and used only to provide a zero potential difference between exposed metal surfaces associated with the electrical systems and adjoining grounded equipment.

## MODERN PORCELAIN PROTECTED WIRING SYSTEM



★ ILLINOIS ELECTRIC PORCELAIN CO.  
Macomb, Ill.

★ KNOX PORCELAIN CORPORATION  
Knoxville, Tennessee

★ PORCELAIN PRODUCTS, INCORPORATED  
Findlay, Ohio



# Industrial Electrification

## DESTRUCTION

THE most revolutionary tactic of this war is the methodical destruction of life and industry far behind the battle lines. As the full significance of air power is grasped and as our fighting forces gain experience in this new tactic, we all hope to see more destruction applied to our enemy's production resources. We hope, too, that our defenses will be strong enough to prevent important damage here.

But, in war, attempts to destroy our industrial production by enemy action is a constant threat. A sneak air raid, desperate sabotage or sheer accident can produce what our British allies call an "incident", which may be anything from a minor shaking up of an isolated department to wholesale destruction of the entire plant.

There are a number of ways that electrical men can help to isolate and limit damage if an incident comes. Mr. Harrap's article on these pages tells what British experience has taught electrical men there. These are facts. It can happen here. It is our job to be ready.

A limited number of reprints of this article are available.

### Previous articles covered—

- Eliminating Causes of Severe Service Conditions
- Providing Adequate Capacity for Increased Demand
- Electrifying Operations to Reduce Unit Costs
- Safety Protection for Electrical Operations
- Increasing Flexibility of Electrical Service
- Electrical Aids to Automatic Control
- Electrical Ways to Reduce Waste How to Save Power
- Protection Against Sabotage
- Improving Working Conditions
- Electrifying for Continuous Operation
- Electrified Plant Housekeeping
- Electrical Problems Under 168 Hour Schedules
- Electrical Aids to Plant Conversion
- Electrical Aids to Quality Control
- Electrical Aids for Green Help
- Codes in Wartime
- Grounding for Safety
- Air Raid Restoration (this issue)

### Future articles will discuss—

- Wiring for Quick Changes
- Limiting Power Demand
- Welding in Industry
- Operating with Minimum Electrical Replacements
- Restoring Electrical Service
- Salvaging Electrical Equipment

ENGINEERING • INSTALLATION • MAINTENANCE

## AIR RAID RESTORATION

### How the British Restore Electrical Services After an Incident

**S**UCH a subject as this is naturally divisible into two major sections, i.e., industrial establishments having their own electric power generation, and those taking a supply from a public utility.

Whatever the form of supply, when damage is sustained it is imperative for the works management to make up its mind about the policy to be followed. If there is private generation and the engine room suffers complete destruction, it is for them to say whether they will continue with their own generation, which means shutting-down the factory until new gear can be installed on the same site, or the old gear can be reconstructed. They should also make a decision on whether to ask the public utility for temporary help, and if they do ask for help, they need to make a definite estimate of their requirements.

If the works is already taking a supply from the utility's system and the substation is demolished, a decision should again be made (depending on the extent of the damage to the rest of the factory) as to whether the establishment shall continue operations or not. If it does, then the utility should be given a reasonable estimate of the power requirements under the new conditions, and some idea of the time within which it will be needed.

Experience has shown the following precautions to be vital. If a factory relies on its own generation, then it must arrange with the public utility for the installation of a standby supply. This should never be brought direct on to

the main switchboard, since that merely becomes a bottleneck, and the destruction of the board makes the standby supply useless. This supply should be brought into a separate substation away from the main engine room, with connections to the factory's power and lighting systems, and a link to the main switchboard. If all supply is taken from utility mains, this will usually be at high tension and the equipment will include at least two step-down transformers. One of these should, if possible, be moved to another part of the factory by extending the high tension cable, and making a new system of connections into the factory's distribution network. Better still, of course, is the provision of an entirely new substation, with incoming cables entering the works by different routes, with its own high and low tension switchgear and transforming plant, all in a stoutly constructed building.

Dispersal of plant, equipment, stores, and personnel, is the keynote for successfully combating an incident.

### Organization

It was at first thought to be a wise plan to keep a special crew of fitters and electricians, with their mates, on standby every night, at the factory. Three things operated against this procedure, viz., the introduction of shifts working in the factory all night and day, with their own maintenance crews, and then the great need to disperse as many employees as possible, especially in target areas like those containing in-



dustrial establishments, and lastly the fact that it is impossible to do any real useful work in a damaged factory, in the black-out, during an air-raid.

Repeated trials have now shown that it is preferable to have a number of crews standing by at home. The number of crews will depend on the size of the factory, but it is imperative not to have all repair gangs on standby every night of the week. Each crew, or set of crews, should take it in turn to stay at home, one night a week, and then it should be their instruction to report to the factory immediately after a raid, even though their own homes are damaged. There must be strict adherence to this instruction. Similarly, a qualified engineer should get to the works as soon as aerial activity has ceased. The remaining crews and engineers should report at the normal workmen's day shift starting time. These remarks obviously refer to night incidents. If an incident should occur during normal working hours, then the crews merely start work on the lines given below.

The purpose of the arrangement mentioned above is to prevent the possibility of the whole staff and crews being worked to a standstill before the repairs are completed. Further, it will take an hour or two before the damage can be sorted out. It is no use dashing at a job of this nature; quiet consideration and steady progress are wanted, with the elimination, so far as can be done, of 'lashed-up' jobs and temporary "rig-ups".

Practice has varied a little in the composition of the crews in factories in Great Britain. That most common is to place a maintenance foreman, or a production superintendent, in each department damaged, and let these men

direct operations. Either one squad can be made up under a foreman, comprising about a dozen or so men, who will be responsible for clearing all debris in the department, or else a number of maintenance crews can be constituted, each comprising a fitter and mate, with the addition of two men for clearing debris around the job. On a big incident, both arrangements would be put into force. Operatives should never be sent home after an incident, but those of a semi-skilled and unskilled calibre should be formed into demolition and debris-clearing crews, while skilled men can be put as assistants to fitters. It will be found that although girls and women cannot do too heavy work, their flair for cleaning and tidying can be usefully employed, by putting them into groups to follow the rough clearing of debris. If fire is the cause of damage, the amount of cleaning of sodden material can be staggering to the uninitiated, while he predominant feature of a high explosive bomb is the colossal amount of dust everywhere.

#### Scheme of Action

No definite infallible scheme of action can be drawn up on paper before an incident, that can be guaranteed to work every time. There can obviously be many permutations and combinations in the damage caused in a factory by either high explosive or incendiary bombs, or both, or shelling, or a combination of them all.

Nevertheless, a scheme can be organized with the knowledge of the damage likely to be suffered by enemy action. It is as well to imagine that vulnerable gear will in fact be damaged,

and preferably it should be taken as a necessary part of any plan that all public utility services will fail. Should the actual occurrence be better than this, then the staff are immediately heartened and put into good spirit by having to tackle something less than the worst possible.

Under the section on Organization, it was pointed out that only a relatively small number of crews are needed on site immediately after the incident occurs. It is essential to have a responsible and well-qualified maintenance engineer at the works at the same time, and it may be desirable to have a good production superintendent at hand also. The first job should be to examine the extent of damage to the main machinery and production plant. A short concise report should be compiled of the extent of the damage and the time likely to be taken in the repairs, provided there is sufficient labor and replacement material available. A similar report should be made out for the electrical equipment, but it must be realized that the data available will not be entirely trustworthy. Defects and damage may be hidden under debris, but at any rate there will be something for executives to make decisions on.

This leads to the next stage. By the time such reports have been compiled, the normal starting time for the operatives will have arrived. They should be set to clear the debris, remembering to give the men rough work, not spending too much time on finer points of cleaning, and then letting the women follow, who will be employed on lighter work. The electrical repair crews should be set to work on the overhaul and checking over of the main electric power intake point or points,

**IT COULD HAPPEN HERE.** Methodical interruption of industrial war effort by bombing is an important part of modern military strategy. Counter-strategy requires expert organization to clean up and restore production in the shortest possible time.



# MAINTENANCE GUIDE SHEET

## BRITISH PRACTICE FOR QUICK RESTORATION OF DAMAGED ELECTRICAL SERVICE

### Planning—Factory Layout

*(Expect the Worst—Rebuilding may be necessary)*

Location or relocation of equipment  
Improved production flow  
Disperse maintenance and repair stocks  
to at least three locations  
Maintain adequate repair stocks  
Know policy to be followed before incident occurs

### Planning—Power Supply

Purchase or generate power under new plant conditions  
Standby power capacity  
Segregated switchboard for standby power lines  
Separate power supply points widely  
Cooperation with utility for quick restoration of service  
Layout to be followed for power distribution  
Dispersal of load centers  
Know interchangeable equipment such as motors, switches,  
etc.

### Organization

Responsible officials in charge  
Divide force into suitable number of reconstruction crews  
Utilize men for heavy work—women for light clean-up  
Crews, when not working, to be in readiness at home  
Rotate crews "on call" to minimize interference with  
home activities  
Place maintenance or production foreman to direct work  
in each department  
Segregate specialist crews—electrical mechanical, steam,  
etc.

### Scheme of Action

Food and drink crews to supply workers  
Salvage crew  
Assume worst condition  
Maintenance engineer surveys damage and estimates repairs at once  
Prepare concise report of damage and replacements needed (much may be hidden)  
Decide promptly—rebuild or quit  
Reconstruction crews start after black-out or air-raid is over  
Give general, not specific, instructions  
Clear debris  
Clean-up (women) crews follows  
Check important items first—power source, boilers, air compressors, etc.  
Clear production units in order of production flow  
Make permanent electrical connections to production units as cleared  
Install electrical system to take new connections without shutdowns  
Equipment remounting crews follows clean-up crews supervised by production engineer  
Utilize interchangeability of motors, etc. to get first production units running  
Start production as first units are ready  
Improve layout where possible  
Be careful during reconstruction, and construct for safety  
Avoid temporary hook-ups—they are seldom replaced

### Probable Damage

#### HIGH-EXPLOSIVE BLAST WITH PRESSURE AND SUCTION WAVES

Shatters glass, porcelain and plastics  
Shatters fibre conduit  
Blown away—open wiring  
Stretches cable and pulls joints  
Punctures conduit  
Puncture cable sheath and insulation  
Puncture transformer case and cooling coils and insulation and fractures insulators and bushings  
Bend and buckle steel work—may drop roof and girders  
Fracture castings  
Fractures feet of firmly fastened motors, starters, etc. from ground shock  
Cracks insulators, generally at metal clamping ring  
Buckles sheet metal switchgear  
Shatters plastic, glass, porcelain and jewel bearings and pivots on relays, instruments, meters, etc.  
Blankets everything with dust

#### INCENDIARY BOMBS

High initial heat  
Burns cable and insulation  
Causes flashovers and short-circuits from electrical conductivity of flames  
Removes temper from fabricated metal  
Motor insulation destroyed  
Transformer leads and oil burn  
Castings fracture due to heat and chill from water  
Large water damage

### Salvage

Little from fire—much from blast  
Obligated to return rubber, copper, aluminum and other scarce materials  
Test installed wiring and cables for continuity  
Test insulation on all wires  
Test contacts in switches  
Test oil-switch oil for contamination due to load and short-circuit operation  
Pressure test transformers and other equipment before reconditioning  
Recondition damaged units later on spare time

### Stores

Maintain more extensive stocks  
Disperse all repair and maintenance stocks of all items to at least 3 points  
Maintain liberal stocks of switches, fuses, distribution panels, etc.  
Make liberal wiring material allowances  
Stock small motors and starters  
Stock spare parts for circuit breakers  
Stock much solder, flux compound, tape, terminals, connectors, etc.  
Stock lamp shade replacements  
Prepare for need of portable battery lamps and small power tools  
Standardize equipment as it is more easily replaced  
Equipment for heavy lifting



after they have helped in the initial survey. It is obviously essential to make sure that whatever the state of the rest of the plant, that in the substation, or at the generating station, or at the service point, must be recommissioned as soon as possible. This will enable even temporary supplies to be taken if the whole of the other plant is damaged, so as to light portable lamps and operate portable tools. One crew should always be detailed to collaborate with the public utility's staff, for if their gear in the factory is damaged they are likely to arrive in a short time after the incident. If there has been an incident in the factory, there will probably have been many more in the neighborhood. Hence the public utility is likely to be especially grateful if a crew is provided to give gratis assistance in getting substations going again.

Meanwhile, the executives of the factory should be studying the initial reports and considering how best to restart production. They will have to assess the effect of damage on different sections of processes, and decide whether the interchanging of machines, and especially motors, will enable a full sequence of operations to be attained once more. This gives the clue to the manner in which repairs should be executed. After men have been put on to the supply point, the debris-clearing gangs should clean those machines which perform the first production process. When they have done this, they should move on to the next, and the fitting crews should take their place. Preferably these should be segregated into electrical and mechanical types, each keeping to his own portion of the plant, and having the help of two operatives if these can be spared and do not get in the way. One extra man or boy at least is very desirable, to run to the stores for spare parts, for material and to collect food and drink. The latter aspect of the arduous and tiring work of resuscitating damaged plant must not be overlooked and special attention can well be given before an incident to the methods by which canteen facilities can be kept going.

In giving instructions to crews, their work should not be delineated too closely. As previously mentioned, a preliminary examination will not show up all defects, when gear is shrouded in debris and dust, and hence the instructions given should not be too detailed, so that men may have to stand idle waiting for a responsible engineer to set them on other work. The crews should be instructed to aim at keeping up with the debris-clearing gangs, and they must not be averse from listening to the production staff's requests for

**WE** usually think of an incident as damage caused by a bomb dropped by the enemy. Actually, just as much interruption to production may occur in an "incident" from other causes some of which are much nearer to home. Equal planning, organization and preparation is necessary to restore the vital electrical services quickly. It is vital for every American plant to be ready to cope with the worst. *Electrical Contracting* arranged with G. V. Harrap, A.A.M., I.E.E., A.M.I.E.E., of the West Ham Corporation, London, an outstanding authority, for this full account of British experience. Needless to say, the practices which the author describes have all been proven sound under prolonged tests following devastating raids.

particular machines to receive treatment. For it should be the aim of the latter to get production going again on the machines handed over by the skilled repair crews, with operatives gradually withdrawn from the debris-clearing gangs. In the drive to get operations going again there is plenty of scope for initiative and ingenuity, but temporary "lash-up" jobs should be avoided where possible. These have a bad habit of never being made permanent, for once the production staff get plant into operation they are loath to release a machine to replace a temporary 'rig-up' that seems to be giving satisfaction. In this matter, reference should also be made to the section on safety.

Stress has been placed in the above paragraphs about crews getting to work on machines and plant. Obviously it is necessary for a section of those engaged on repairs to attend to the power and lighting supply lines within the factory. Again, their work should be directed towards getting lines into commission which feed the machines coming first in the process of production. Care should of course be taken, to incorporate any improvements devised or suggesting themselves, and the work should be done so that connections can be made to further reconditioned machines and plant, without the necessity for shutting down those that have already been restored to operation.

Although the above comments have all suggested the replacement of wiring, cabling, machine and process layouts, into the same condition and disposition that they originally held, yet the executives' duty is really larger than this. When considering the initial reports of the damage done, thought should be given to the possibilities of incorporating improvements. These latter can cover the actual disposition of plant, or their sequential order, or may refer to the electrical distribution sys-

tem, or the lighting arrangements, etc. It is likely that certain improvements have been in the minds of some at least, of the executives for quite a while, and there may exist reports, sketches and estimates for possible alterations, all in the files of the works manager.

### Damage Sustained

In general it can be taken that blast from high explosive bombs will shatter plastics, glass, porcelain, etc., will bend and buckle steelwork, fracture castings, and bring down roofs and girders on to gear. One of the most noteworthy results of such a bomb bursting in a factory is to produce vast quantities of dust, which will cover everything for very many yards around. Another thing to note is that there will be a suction wave in the atmosphere as well as a pressure wave.

The following are examples of damage likely to be sustained. Motors firmly fixed to bedplates or to the floor are likely to have their feet broken off near the body of the stator, because of ground shock, if there is no resilient material between them and their foundations. This naturally applies more to machines built of cast material, and in general fabricated steel structures are the best for withstanding blast. Starters suffer in the same way, where they have cast iron feet; many examples of this type of apparatus have glass fronts, and this material naturally gets blown into the contacts and brush arms, etc.

Sheet metal, air-insulated, switchgear suffers badly from blast, although it seems to withstand fire very well. A point to make sure about when examining this class of gear on recommissioning is that no insulators are cracked or broken. The commonest and least visible place for this to happen is in the metal clamping ring.

Underground cables going close to the crater of a high explosive bomb will probably only be stretched, though they may pull their joints a good many yards away, especially if the cables are laid in ducts. A continuity test is therefore valuable before putting them into service again. Cables on walls can be punctured in many places by splinters and flying debris, while those on roofs will most likely be blown up in the air, severed, and then be entangled with twisted roof girders.

Relays, instruments, meters, and any delicate control apparatus, all have a high rate of mortality from blast, especially those with glass or plastic cases.

Steel conduit or wiring will probably be punctured and the internal wiring will certainly need testing for insulation resistance and continuity, before being put back into service. Fibre con-





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duit shatters badly and ordinary cleated wiring is just blown away, along with fuse boards, wall switches, lamp shades.

The destruction caused by an incendiary bomb, if it acts successfully from the enemy's point of view, is the same as for any other fire, with the possible exception that the bomb sets up a very high initial heat. It must be remembered that *flames are electrical conductors* and hence may produce flash-overs on live bare metal by which they pass. Paper- and rubber-insulated cables suffer badly from fire, fabricated metal loses its temper, castings are fractured, motor windings have their insulation destroyed, and water is likely to get into everything. Transformers suffer badly both through fire and blast, because of puncturing of cooling tubes, fracturing of cast top and bottom pieces, and ignition of cables, wooden cable bushings, and the insulating oil itself.

Where possible, major items of electrical gear should be pressure tested before recommissioning, but entire reliance must not be placed on this test. The use of an insulation testing set is invaluable, and will show defects not disclosed by high-pressure testing sets. Every crew should be equipped with a portable, 1,000 v. testing set for insulation resistance.

Most incidents cause faults on the electrical system in a factory, and hence it is necessary to look at control switch contacts for burning and for contamination of oil. It is important to examine the rupturing capacity of circuit breakers in relation to the short-circuit power available, before incidents occur, for it would be disastrous if the failure of a circuit breaker were itself to set up another fire through its failure to clear fault current.

#### Salvage

The amount of material that can be salvaged will depend to quite a large extent on the type of incident, i.e., whether it be the result of a high explosive or an incendiary bomb. If a fire results from the latter, the salvage is likely to be small, for items such as paper- or rubber-covered cables will be destroyed, whereas blast will normally only stretch them, and possibly puncture them in places. Fire will also destroy the temper in fabricated steel whereas blast only buckles and bends. With cast metal parts, although blast will usually fracture these, such material can withstand fire to a greater degree, but the application of an extinguishing medium like water may so suddenly chill the castings as to fracture them.

From all of this it will be seen that almost every case would have to be

taken on its merits. The salvaging of material will obviously depend on Government orders too, making it obligatory to return any copper, rubber, aluminum, or other material, to the appropriate authorities for re-use.

But material must not be incontinently thrown on a scrap heap. Apparatus must always be examined with a view to its refitting by the maintenance crews in their spare time. Since such men do not normally have much spare time in these days, and in any case the manufacturer can often do the work at a cheaper all-round cost, consideration should always be given to returning the damaged gear to the maker. This is especially true with motors, starters, etc., where suitable stocks can be carried to act as replacements on the main machine; but items such as fuse boards, pushbuttons and other light apparatus, are not usually worth keeping and reconditioning.

#### Stores

Much of what can be done after an incident is conditioned by the preparations made beforehand. It has been found that the stocking of equipment and parts must be much more extensive than in normal times, if satisfactory repairs are to be made after an incident. This means tying up a good deal of the factory capital in unproductive material and may, in these times, be rather a strain on the works finances. Other difficulties may present themselves, but if the equipment is well looked after and care taken not to lose parts, then the stock will be extremely valuable after the war for maintenance work. For at that time it is likely that the gear will be dear, and may be scarce.

The same precaution of dispersal is imperative. Where there are a number of factories under one organization, it is wise to put the spares for one factory into the stores at another. This is especially true for items made to a special design, the replacement of which is therefore likely to take a long time. In many factories it is the practice to have one store to take all plant maintenance material. This must be changed and it is advisable that there should be at least three for war-time. Moreover, it is vital never to stock all of one kind of equipment or spares, in one store. Each store should hold as complete a set of replacement parts, etc., as it is possible to get.

For the actual material required, both kinds of incident need to be considered.

Previous remarks on the repairs needed will give some idea of the quantity of spares required, but there should be a liberal stock of ordinary switches, fuses, distribution boards, small motors

and starters, and a very large amount of wiring material. It is wise to keep a good stock of spare contacts for circuit-breaking devices, for it is much more profitable to replace burnt contacts by new ones, and then "touch-up" the old contacts at leisure afterwards, than to try to do this when men are being rushed to get production going again.

A good stock of material must also be built up of the things used to install the replacement apparatus. Solder, flux, compound, tape, terminals, connectors, etc., are all vital, and in the rush of restoring plant to service the rate of breakage and loss of repair crew's tools usually goes up considerably, and this must be covered. It is a wise plan to tour the factory and imagine how certain gear must be lifted if dislodged by blast. Blocks and tackle, sheer legs, and adjustable girders are all valuable in saving time in restoring the plant to normal. In considering the equipment to stock against an eventuality like an air raid, it must be remembered that all electricity supply may fail for at least a while. Portable battery-operated lamps, and paraffin lamps of the same type, have given good service in emergency. Stocking must be allied with safety precautions. Hence operators must not be called on to work at newly rehabilitated machines with unscreened lights, etc. Lamp shades suffer badly from blast and both they and the lamps themselves should be stocked in dispersed stores, in good quantities.

#### Speed and Safety

It is after an incident that a great advantage is reaped by those factories that have kept to standard equipment in their installations. It is much easier to obtain new replacements "off the shelf" or second-hand lines from merchants, if standard articles are required.

These are also times in which ingenuity should have full play too, and when exactly duplicate replacements are not demanded. Somehow, by some means or another, machinery must be got going again. There is however, a most important point that should receive constant attention. This is safety. When manpower becomes even more scarce and valuable, injuries and accidents are relatively all the more costly. To replace damaged apparatus by slipshod methods and hasty improvisations, with too much thought on getting plant going again and too little on the safe running of the gear, is false economy. It is no use saving a little time in the replacement of damaged gear, if through some unsafe "lash-up," the operator is injured and put off work for a long time.

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# Reader's QUIZ

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay \$5.00.

## VARIABLE RESISTANCE

**Q** QUESTION 64. Can the speed of a compound-wound motor be adjusted by the use of a variable resistance connected in series with the shunt field winding, as in a shunt motor?—R.C.M.

**A.** TO QUESTION 64. The answer to this question is yes. Two main factors which govern the speed of all d.c. motors depends on (a) the strength of the main magnetic field (b) voltage applied to armature.

Decreasing the strength of the main magnetic field will increase the speed above normal. Therefore, by connecting a resistance in series with the shunt field winding, the strength of the main magnetic field is decreased making the motor run faster than normal.—F.C.

**A.** TO QUESTION 64. Speed control (increasing the speed from and decreasing the speed down to the nameplate r.p.m.) by weakening the magnetic flux of the field is commonly used with shunt motors. With this method a shunt motor will run at nearly constant speed for any setting of the field rheostat. The shunt field method of speed control can also be used with compound motors, though for any rheostat setting there will be some variation of the speed with the load. This variation of the speed is due to the changing flux caused by the variation of current in the series field coils as the load varies.—J.R.

**A.** TO QUESTION 64. Whether or not speed control of a compound motor is feasible by the use of a shunt field rheostat is dependent on the degree of compounding.

If the series field predominates, with a light shunt field winding to limit top

speed, a shunt field rheostat will have little or no control. If the shunt field predominates, with a light series field for stabilizing, then the speed can be controlled over quite a range perhaps 3 or 4 to 1, by use of a suitable shunt field rheostat.—J.W.B.

**A.** TO QUESTION 64. Yes, within limits fixed by centrifugal force and brush sparking at high speed (weak field) and by winding heating at low speed (strong field). A range in speed from 90 to 120 percent of normal should be made available by the use of a suitable shunt field rheostat. The various speeds obtainable by the method suggested will be nearly constant and because of the low rheostat losses, the motor's efficiency will not be materially affected. Motors for adjustable speed service are either shunt of compound wound, and so designed as to have a speed range as great as 4:1 by field control. Their horsepower ratings may be constant through the entire range of speeds or vary with the speed, depending upon the design.—R.B.G.

**A.** TO QUESTION 64. The speed of some compound motors can be adjusted within comparatively narrow limits by regulating the shunt field current. In general, caution should be used in operating a compound motor with a weakened shunt field because the effect of series field causes wide variations of speed with varying loads. Dangerously high speed would result if the load were removed from a compound motor when operating with a very weak shunt field. A shunt across the series field would give more nearly shunt motor characteristics and better field control. If your compound motor has interpoles, it will add to your success with field control.—M.H.

## MOTOR OPERATING VOLTAGE PROBLEM

**Q** QUESTION 65. What are some of the main considerations where a choice has to be made between the use of high voltage motors, say, 2300-volt as compared to a standard secondary voltage of 460-volts, assuming that the power company is prepared to supply either 2300-volt or 460-volt service, as the customer might elect to use?—J.M.T.

**A.** TO QUESTION 65. When confronted with a motor operating voltage problem there are numerous factors to consider. Included among these various items are the location, capacity, possibility of grouping, operating hazards, maintenance, priority on material and winding design features. At the present time, it is very advantageous to be able to remove a defective set of coils and reinsulate each turn, rather than scrap the copper. This can only be effectively accomplished if the copper is relatively large and the coils have a few turns. Consequently, with a high voltage winding this can seldom be done unless the motor is of considerable capacity.

One main feature in favor of high-voltage, is the reduced copper I<sup>2</sup>R loss. This is a distinct advantage where a large manufacturing plant is supplied, especially if there are many motors with a capacity above 50 hp. and the atmosphere is normal. Motors smaller than 50 hp. may be supplied through step-down transformers. Where local conditions are subnormal a high-voltage motor is a maintenance headache.—O.A.

**A.** TO QUESTION 65. Assuming that the efficiency of both types of equipment is equal, and also the application of both types of equipment is satisfactory, I would give the following main considerations: 1. Cost of Operation—The power cost should be taken into consideration, paying particular attention to transformation losses, if any, and the I<sup>2</sup>R or power losses in the wiring. The higher voltage equipment would create high maintenance cost. 2. Cost of Equipment—A comparison of cost of both types of equipment should be made with considerable weight given the necessity of a larger cross-section of copper being required in the wiring to the lower voltage motor. Also a higher cost of controlling the high voltage equipment. 3. Safety Factor—In many instances on a lot of operations this consideration should be placed first. Naturally, the

higher voltage would require a greater effort and cost to protect life and the type of application of this equipment should be known before much could be said on this subject.—J.B.C.

**A.** TO QUESTION 65. In deciding whether to use 2300 volt motors or 460 volt motors for a particular installation, attention should be given to the total connected load, the size of the motors being used, the purpose, the location and the duty cycle of the motors and the training and qualifications of the available employees.

If the installation is small it is evident that it will be better to keep equipment simple and this indicates the lower voltage. If there are large individual motors if they are to be used for driving large compressors or perhaps some of them for power factor correction, the high voltage may be better. The 2300 volt motors will probably not be available in sizes below 40 horsepower and the 460 volt in sizes above 400 horsepower. In general, the 460 volt motors will be too large even for horsepowers below this.

The lower voltage motors will require much larger conductors and the control equipment will be bulky and expensive for the larger sizes. For the smaller sizes the high voltage equipment requiring more insulation and proper inclosure will in general be less desirable.

To sum up, lower voltage equipment should be used for smaller motors, where motors and starting equipment are to be handled by men who are not specially trained electrically, where loads are not too great and where lengths of runs can be kept down. Higher voltage motors will be adapted for large motors, especially those used for continuous duty, for power factor correction, and where voltage drop is serious.—J.E.W.

**A.** TO QUESTION 65. The problem which you have presented is principally one in engineering economics.

The factors favoring the higher voltage include the following which are in some instances related to each other: 1. Smaller conductors. 2. Lower copper losses. 3. Better regulation. 4. Isolation of equipment practically essential, hence is protected from unauthorized workmen. 5. Suitable for standard equipment with power rating higher than that which is standard for the lower voltage. 6. Larger blocks of power available from power company at possibly a more attractive rate.

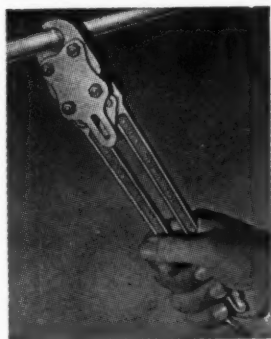
The factors favoring the lower voltage include the following: 1. Lower cost of motors and control equipment. 2. Lower insulation required, hence installation and maintenance may be done



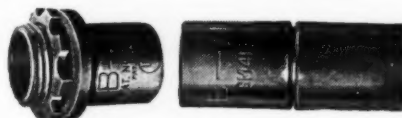
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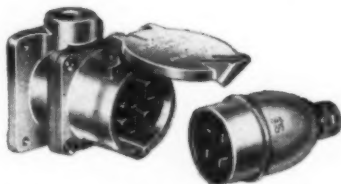


# PLUGS and RECEPTACLES

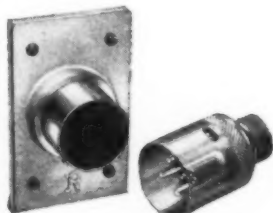
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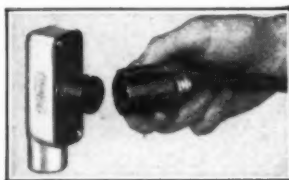
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## Reader's QUIZ

[FROM PAGE 103]

by men of lower skill. 3. Usually lower short-circuit kva. 4. Suitable for standard equipment with power rating lower than that which is standard for the higher voltage. 5. Equipment available from greater number of sources.

Evaluating the fixed charges and maintenance costs on an annual basis and adding thereto the estimated annual operating costs should provide sufficient cost data for deciding which voltage to specify.

It is considered good practice, in general, to use the higher voltage if the motors exceed 150 hp. and to use the lower voltage where an appreciable number of motors are below 50 hp. due consideration being given to the factors and costs outlined above.—G.I.S.

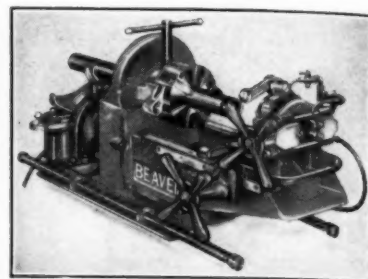
## ELECTRICAL DISCHARGE IN AIR GAP

**Q**UESTION 66. Recently while inspecting a large totally enclosed synchronous motor an electrical discharge was observed in the air gap between the stator and rotor. This arc or discharge occurred only during the starting period. The end bells were off at the time. The usual tests for grounds opens, etc., did not show any trouble. Is this a common occurrence on this type of equipment and is the discharge likely to harm the machine?—J.A.H.

**A.** TO QUESTION 66. The electrical discharge is most likely caused by a broken bar or bad connection in the damper winding on the pole faces. This winding carries a heavy current at starting, while at synchronous speed it carries little or no current. Being one of many bars in parallel it has no noticeable effect on starting but in time may spread to other bars or to the field windings due to the intense heat at the arc.—C.F.R.

**A.** TO QUESTION 66. The discharge may be due to an opening in the field circuit (usually the rotor). During the starting period there is an induced current in the field. This induced current should be absorbed by the field resistance which is connected through a switch to the field during the starting period only. In case this induced current was not kept under control by being connected to a suitable resistance, the voltage might soar to an

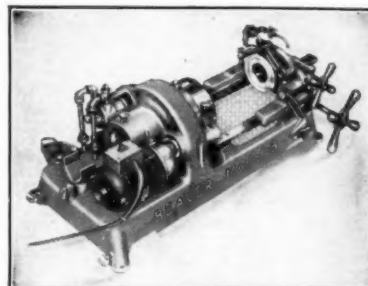
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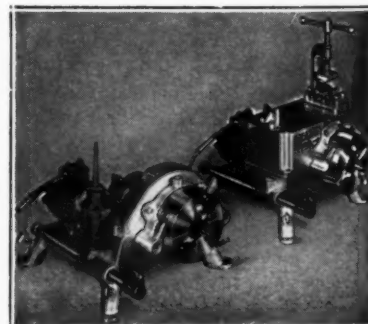
Write for Bulletin A



### Beaver Model-B

A light-weight utility Pipe and Bolt Machine combining many features of Model-A with the easy portability of Model-C. Range 1/8 to 2-inch up to 8-inch with drive shaft and geared tools. Bolts up to 1 1/2-inch. Weight 280 lbs.

Write for Bulletin B



### Models C-1 and C-2

A STURDY LITTLE POWER UNIT Converts hand pipe tools into power tools from 1/4 to 8-inch. Threads 8-inch in 6 minutes. Threads bolts up to 1 1/2-inch. Two men can work at the same time without interference. Weight 150 lbs.

Write for Bulletin C

Write for new Tool and Machine Catalogue—Just off the press

## BEAVER PIPE TOOLS

1043 Deen Ave., Warren, O.



extremely high value it being governed only by the turn ratio between the stator and the field windings. This induced voltage might assume such proportions as to breakdown insulation and jump between the air gap. However the rotor and bearing pedestals would have to be insulated from the stator for this condition to exist.

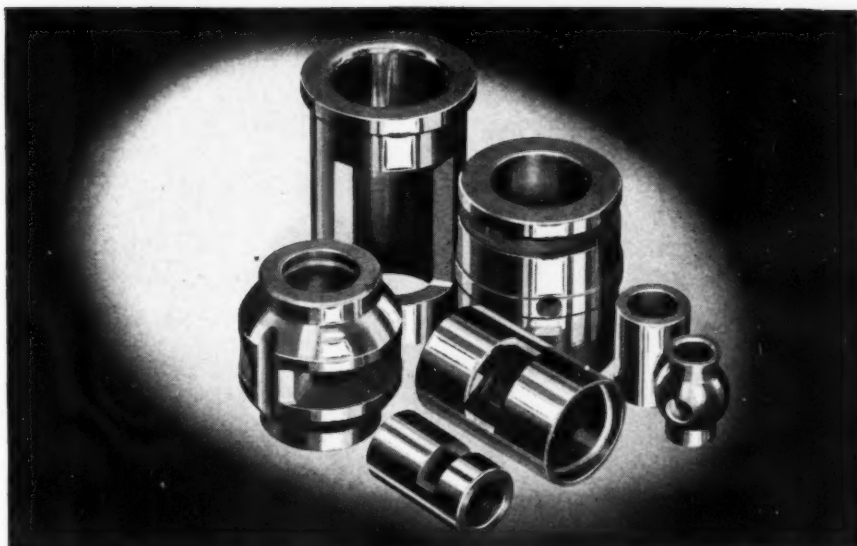
Check the field resistance and the wire running to it for a possible open also check contactors that connect the field to the field discharge resistance. This contactor should remain closed throughout the starting period. Just before the exciter current is applied to the field, the field discharge switch (or contactor) should open.—C.C.O.

**A.** TO QUESTION 66. The discharge may be explained in either of two ways.

If the rotor is electrically insulated from ground and the motor is belt connected to its load, the rotor could accumulate a static charge from the belt, especially on starting if the belt slipped on the motor pulley. This static charge could discharge across the air gap to the grounded stator. This explanation is offered since the motor is obviously one which has an isolated rotor since it can be operated without end bells. Under normal operation, the end bells would conduct away the static charge. The writer does not know of a motor installation in which the rotor and bearing structures are insulated from ground to the extent where an electrostatic charge could be accumulated thereon sufficient to jump an air gap.

If the motor is started with field circuit open, a high voltage would exist between the slip rings at the instant of starting. It is conceivable that the shortest discharge path for this voltage might be from an exposed field conductor across the air gap to the stator, thence across the air gap again to another field conductor of opposite polarity. Such a discharge would certainly be harmful in that the field conductor would be injured and eventually burn open. A properly designed discharge path for the induced energy would prevent such a discharge.—G.I.S.

**A.** TO QUESTION 66. While the discharge observed appears to be in the air gap, more likely it is at the outer portion of the rotating fields, and is an arc-over from the field conductors to ground, probably due to an open circuit in the starting field discharge resistor. During the starting period, the rotating fields act as the secondary of a step-up transformer, the stator coils being excited from the line as the primary. This induces a high voltage in the field coils, and a discharge resistor is shunted across the fields during the starting period, to dissipate the energy



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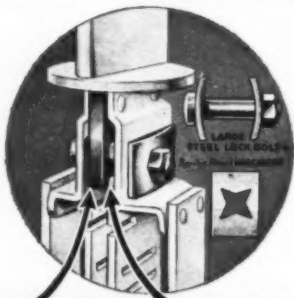
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# WARE

Renewable  
HI-LAG FUSES

## Reader's QUIZ

[FROM PAGE 105]

and hold down the induced voltage to a safe value. If this resistor is omitted or becomes open-circuited, the induced voltage at starting may be sufficiently high to break down the field insulation causing serious damage. I would suggest that the circuit through this resistor be carefully checked to be sure that it is closed during the starting period.—H.G.T.

### Can You ANSWER these QUESTIONS?

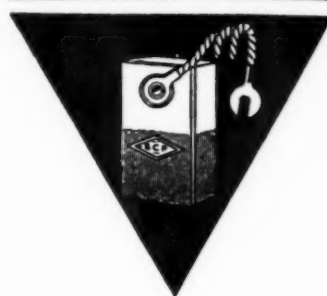
**QUESTION W2** In a boat yard there is an electric hoist 440 volt, 20 hp., three phase slip ring motor with controller and grids. used for pulling boats up the ways. When the pulling cable is attached to the boat and the motor started, the boat hits the ways very hard and there is apparently no reduction of speed at the lowest point on controller until the boat is out of the water and climbing the ways. What is a remedy for this condition at not too much cost?—R.M.

**QUESTION X2** With 220 volt equipment where one phase wire or one point of the circuit is grounded, an insulation failure to the motor frame should result in opening the over-current protective device if the frame is grounded. With the 440 volt equipment there is no ground connection on the circuit. The result is that the frame may remain alive and an accident may occur. What feasible precaution may be taken? We realize that proper maintenance, cleaning and checking are important but wonder if any specific remedies have been devised.—J.E.W.

**QUESTION Y2** We have an electric driven welding machine and a few months ago while the operator was reducing his current the lock nut on the adjustment lever became loose and fell off. The operator not noticing it turned the lever too far down thus causing one of the main brushes to short out against a small exciter brush. There was a flash, and immediately the generator's polarity reversed itself. The positive terminal then became negative and remained in this condition until the same accident was repeated after which the polarity again reversed thereby righting itself. What caused this polarity change?—E.B.

PLEASE SEND IN  
YOUR ANSWERS BY NOVEMBER 1

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# Modern Lighting

## COMFORTABLE OFFICE LIGHTING

Much research has been conducted to determine the lighting conditions which provide optimum visual comfort in the office, where work is composed almost entirely by seeing tasks. Two of the attributes revealed by these studies are (1) considerably much more light should be on the work than at the eyes, and (2) the light sources within the normal field of view should be of low brightness.

These factors were carefully considered when the lighting system was designed for the new office building of the Caterpillar Tractor Company. An aluminum-finished troffer having a modified parabolic contour was selected because little light is directed from the bottom of the unit towards workers'

eyes. Therefore the brightness of the units in the direction of the employees is of a very low order of magnitude and there is little contrast with the ceiling section between rows. The illustration shows a nighttime view—note particularly how the brightness of the lighting units and the ceiling blend together at the normal viewing angle.

The illumination is over 50 foot-candles average in service using 40-watt white fluorescent lamps in single-lamp continuous parallel troffers on 4-foot centers. An additional feature of the installation is the addition of two extra troffer units at the outside-window end of every third row of troffers. Since the windows let the artificial light out, the extra units tend to keep the illumination at the sides of the room to the same level as in the interior on very dark days or at night.



**CONTINUOUS TROFFERS** spaced four feet apart with single row white fluorescent lamps are aided with booster units to allow for light lost through windows. Extra troffers are at the extreme left in this photo.

## LIGHT HELPS THOSE WHO NEED IT MOST

"Advancing years tend to dim the eyesight of older workers whose skill and knowledge are needed now as never before. When old-timers are provided with good lighting, tailored to individual needs, it is frequently possible for them to keep on doing the precision work for which they are fitted, instead of being assigned to other tasks where their



**OLDER EYES** may be backed by precise skills working under the limitation of improper lighting.

training and experience are of little value."

This quotation from the booklet "Plant Efficiency" issued by the War Production Board keynotes a common bottleneck to industrial production today. As more and more older employees are called upon to do the work



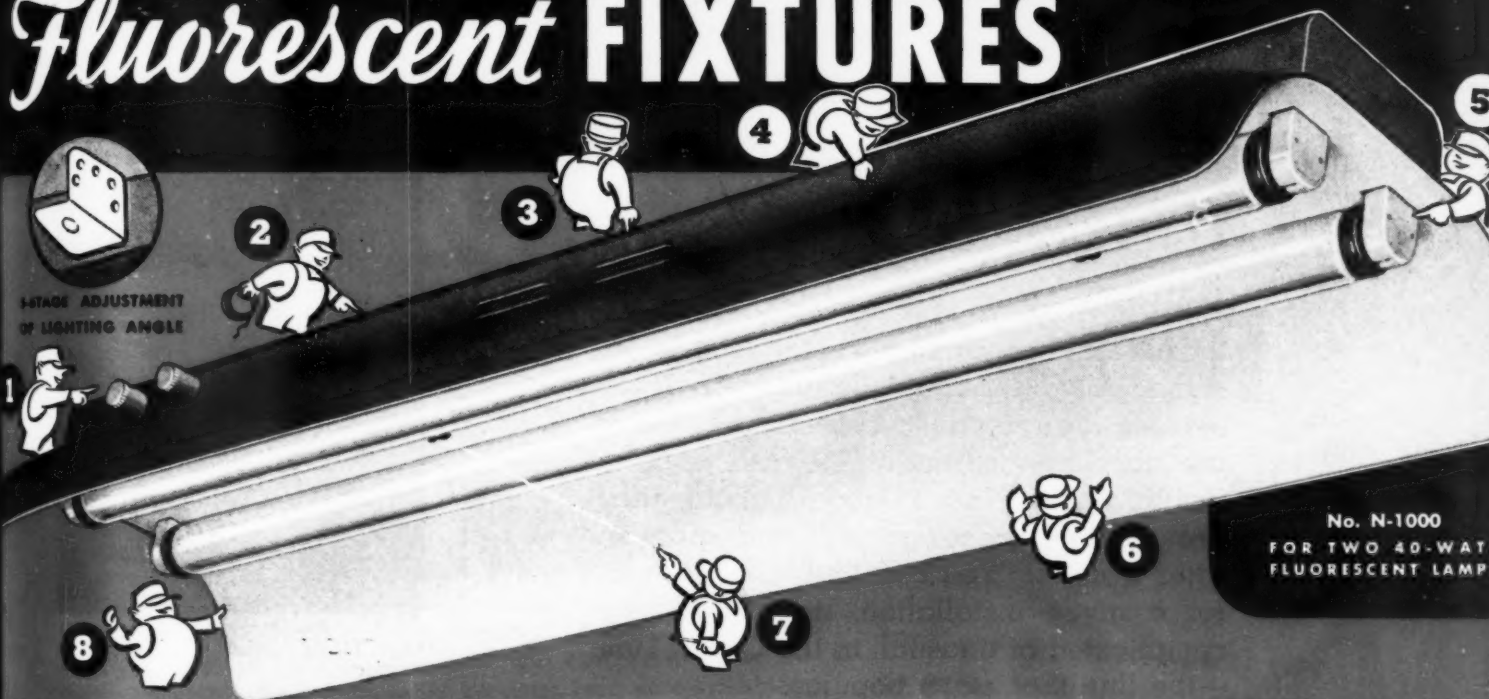
**RELIGHTING** with diffused and adequate lighting equipment gives the older workman the correct quantity and quality of light.

left by younger men who leave for the Armed Forces, the need for adequate levels of comfortable illumination will become even more pronounced.

The two illustrations show the simple steps necessary to improve illumination

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OF LIGHTING ANGLE

No. N-1000  
FOR TWO 40-WATT  
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1. Approved "GLO" starter on outside of housing, for easy access.
2. 20-gauge steel housing, enclosing ballast and wiring.
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### I. L. C. No. N-1000 NON-METALLIC REFLECTOR METAL TOP HOUSING

For two 40-Watt Lamps. Non-metallic Reflector with white I.L.C. BAKED enamel reflecting surface. All finishing and baking done in our own factory, under rigid inspection. 20-gauge steel housing. Outside of reflector and housing finished in industrial gray enamel. Overall dimensions 52" x 13 3/4" x 7 1/4". Approved high power factor ballast, approved sockets, approved "GLO" starters mounted on outside of top housing for easy access. Knockouts in top and ends of housing to facilitate standard installations of rigid or flexible conduits. Completely wired for 110-120 volts, 60 cycles, A.C. Prices on request for other voltages. Packed in Individual Carton.

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### I. L. C. No. N-1500 NON-METALLIC Reflector METAL TOP HOUSING

For three 40-Watt Fluorescent Lamps. Otherwise same specifications as No. N-1000 illustrated above.

### I. L. C. No. N-2000 NON-METALLIC Reflector METAL TOP HOUSING

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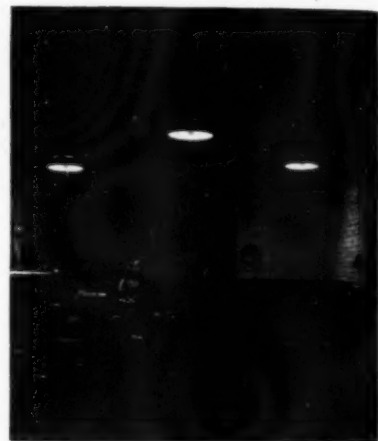


[FROM PAGE 108]

both as to quantity and quality over this bench operation involving fine adjustments.

#### FACTORY BLACKOUT LIGHTING

Where filament lamps in industrial-lighting installations are housed in reflectors which come down well over the lamps, practical blackout lighting can be provided by dropping the voltage on the lamps to the point where the light



**PRACTICAL BLACKOUT** lighting provided by cutting the lighting system voltage to reduce output per unit to three lumens.

output per unit is three lumens or less, that being the maximum light output permitted by the War Department Specifications for Blackout of Buildings. The following table indicates the per cent of rated volts and the resultant lamp current which gives 4 lumens output for various sizes of filament lamps. Assuming reflector efficiencies varying from 40 to 75 per cent, the net light output per unit will fall within the  $1\frac{1}{2}$  to 3 lumen range specified by the War Department.

Lamp Size	Per Cent Rated Volts	Per Cent Amperes
15-watt	42.1	60.1
25-watt	36.4	55.5
40-watt	38.0	62.4
60-watt	30.8	54.0
75-watt	30.5	55.4
100-watt	26.3	48.9
150-watt	24.4	48.0
200-watt	23.2	46.7
300-watt	21.0	44.0
500-watt	18.7	40.5
750-watt	17.3	39.0
1000-watt	15.7	36.5



# Now!

## RLM CERTIFIED

### *Non-Metallic* FLUORESCENT REFLECTORS



● Yes, metal-conserving industrial fluorescent lighting units will now be available with the RLM LABEL... certified by Electrical Testing Laboratories to meet rigid RLM Specifications... carrying the same 90-day minimum guarantee heretofore available on other RLM Units.

These new, non-metallic Fluorescent Reflectors are built to rigid specifications developed by the Institute, and based upon studies and tests conducted by the engineering laboratories of various RLM manufacturers. Rigid and continuous inspection and testing by Electrical Testing Laboratories assures conformity to RLM Specifications by all manufacturers authorized to supply RLM Certified non-metallic reflectors with RLM Labeled fluorescent industrial units.

For full particulars on RLM Fluorescent Non-Metallic Reflector Specifications, write any manufacturer of RLM Industrial Fluorescent Lighting Units or the RLM Standards Institute for RLM Emergency Specifications No. 15, No. 16 and No. 17.

**LOOK FOR THIS LABEL AND BE SURE  
OF METAL-CONSERVING FLUORESCENT  
LIGHTING *At Its Best!***

Only lighting units that have been tested, inspected and certified under the auspices of RLM Standards Institute by the Institute's official testing laboratories as in conformance with the above specifications may bear the RLM LABEL.

Thus, the RLM LABEL becomes the user's warranty that the War-time Non-Metallic Reflector, as well as all other component parts of the Industrial Fluorescent Lighting Unit bearing it are properly engineered and built to give maximum light output and trouble-free operation.

### *Guarantee*

This RLM certified lighting unit, when properly installed and under normal conditions of use, is guaranteed against mechanical and electrical defects for a period of 90 days from date of delivery to the purchaser. Correction of such defects by repair or replacement of material only shall constitute fulfillment of all obligations under this guarantee by the undersigned manufacturer or distributor.

#### MANUFACTURERS OF RLM REFLECTORS

ABOLITE REFLECTOR COMPANY,  
West Lafayette, Ohio

BENJAMIN ELECTRIC MFG. CO.,  
Des Plaines, Ill.

BRIGHT LIGHT REFLECTOR CO.,  
Brooklyn, N. Y.

DAY-BRITE LIGHTING, INC.,  
St. Louis, Mo.

GOODRICH ELECTRIC COMPANY,  
Chicago, Ill.

THE MILLER COMPANY,  
Meriden, Connecticut

OVERBACH AND AYRES MFG. CO.,  
Chicago, Ill.

QUADRANGLE MFG. COMPANY,  
Chicago, Ill.

SMOOT HOLMAN COMPANY,  
Inglewood, California

WESTINGHOUSE ELECTRIC AND  
MFG. COMPANY,  
Cleveland, Ohio

WHEELER REFLECTOR CO.,  
Boston, Massachusetts

**RLM STANDARDS INSTITUTE**  
INCORPORATED

307 NORTH MICHIGAN AVE. • SUITE 1600 • CHICAGO, ILL.

# SPERO

**It's NEW  
INSTA-LITE**  
*gives you Instant Starting  
and Instant Lighting with  
NO starting switch*

**NO STARTER  
means  
LESS TROUBLE**

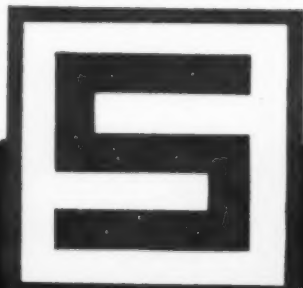


On every sector of the industrial front the demand is for constantly better lighting, simplified equipment to speed up installation in new plants, dependable performance and a minimum of maintenance. The demands of production for Victory are foremost in Spero design—and the latest example in the new Spero INSTA-LITE which eliminates the old-type starting switch for fluorescent.

INSTA-LITE gives you instant starting and instant lighting. It stabilizes the lamp performance and lighting level with maximum lumen output, minimizes stroboscopic, operates at maximum efficiency at lower temperatures, starts on lower voltages. And all these are obtained with low power losses, high power factor (90% or over), no radio interference, no flicker.

The elimination of starter switches from high mounted fluorescent fixtures means far less step-ladder maintenance work. It often costs more to replace a starter switch than the switch itself. INSTA-LITE eliminates both of these costs. The extra first cost of INSTA-LITE is only a small part of the savings it makes possible. And on top of that its greater efficiency gives more light.

**Special Note to Architects and Engineers: Specify SPERO and give your clients the most advanced fluorescent.**



## THE SPERO ELECTRIC

18222 LANKEN AV

# DUR-O-LITE FLUORESCENT

*Looking for More Production*

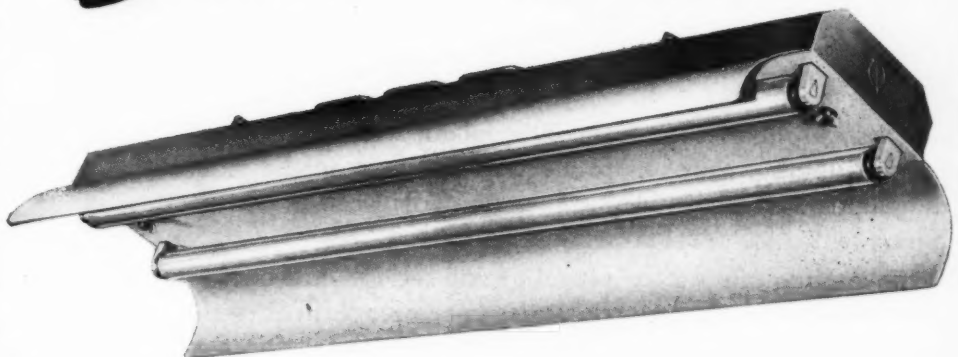
Here is fluorescent equipment you can sell and that you can get delivery on, because it recognizes today's restrictions on critical materials—and anticipates possible further restrictions by W. P. B. Spero DUR-O-LITE design meets fully every demand for simplified, easily installed, easily maintained units for war plant use. It meets design specifications of The Bureau of Standards. It comes up quickly, delivers high grade lighting that stays efficient with least maintenance cost and labor.

Wiring and auxiliaries are mounted in raceway above the reflector . . . reflector can be dropped easily for cleaning. Standard design is for two 40-watt, 110-125 volt A. C.

Wire, phone or write us now for full details and prices. Cash in now on this highly efficient and *now* available DUR-O-LITE metal-saving fluorescent reflector plus INSTA-LITE performance.

## DUR-O-LITE

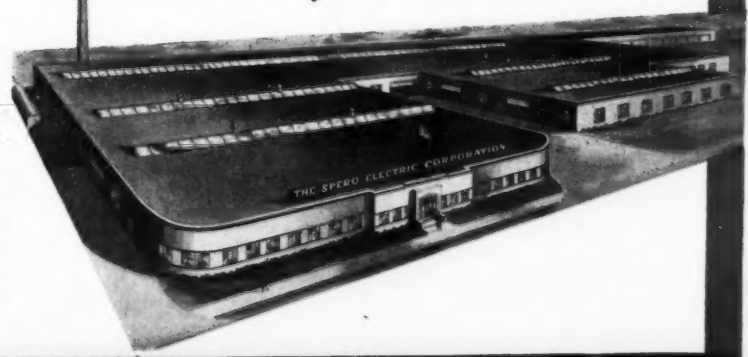
plus INSTA-LITE



## SPERO 5 LINES of Products from one dependable source

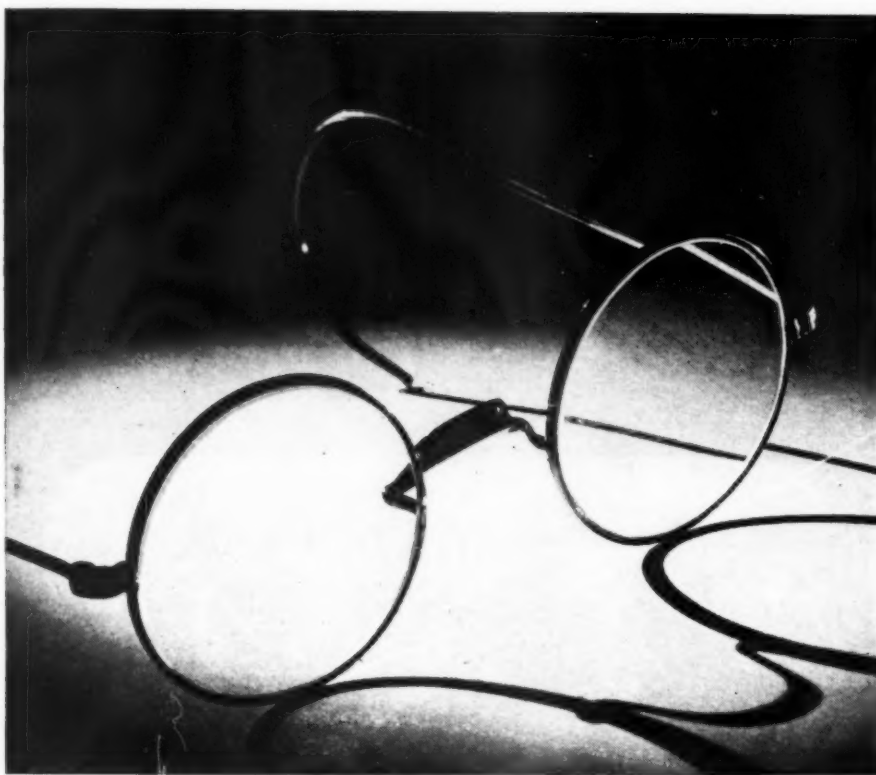
- Fluorescent Fixtures • Incandescent Reflectors • Floodlites • Vapor Proof Units • Electrical Construction Materials

Thirty years experience . . . and a big modern factory with 70,000 square feet of floor space . . . an established name and reputation for high quality products are important considerations under today's conditions. You don't have to gamble when you specify SPERO. SPERO products are distributed only through electrical wholesalers.



**TRIC CORPORATION**  
★ CLEVELAND, OHIO





## There will be FEWER OF THESE

Eyeglasses symbolize eyestrain. By reducing eyestrain through proper lighting, your war production can be increased both in quantity and quality. Fewer man-hours will be lost, fewer rejects will come off your production lines.

Silv-A-King offers a complete lighting service—fine equipment (either fluorescent or incandescent) plus skillful engineering to lay out your lighting installation for maximum effectiveness. Our ability to serve you well in lighting comes from 21 years of experience as industrial lighting specialists. A Silv-A-King lighting engineer is at your call wherever you are located.

Bright Light Reflector Company, Inc.,  
1033 Metropolitan Avenue, Brooklyn, N. Y.



Write for new, 16-page Silv-A-King book:  
"Light Is An Essential Production Tool"

#### A Few Typical Silv-A-King Users:

AC SPARK PLUG  
GENERAL MOTORS  
FISHER BODY  
INTERNATIONAL HARVESTER  
JONES & LAUGHLIN STEEL  
PITTSBURGH PLATE GLASS  
and many others



**SILV-A-KING MAKES *Light* WORK FOR YOU**

*Modern  
Lighting*

[FROM PAGE 110]

It will be seen that for the lamp sizes commonly encountered, a voltage of something like 1/5 of normal is required to reduce the light output to 3 lumens per fixture. This is accomplished by:

1. Providing a transformer of the desired voltage and a means of throwing the lighting panelboard over to this supply.
2. Rebuilding the panelboard so that five lighting circuits can be quickly placed in series with each other (in most cases this is not easily accomplished).
3. Opening the main switch on the panelboard and shunting a resistance across it. Cast iron resistors are probably most suitable for this purpose. It must be remembered, however, that 20 per cent voltage puts about 40 per cent current through the lamps so the resistance must be capable of disposing of a large amount of energy.

The photograph shows a filament installation dimmed down to blackout levels by reducing the branch circuit voltage.

This method will also work on combination mercury-filament installations. This reduction in voltage will not sustain the mercury lamps and they will drop out; the filament lamps providing the necessary blackout lighting.

It should be pointed out that neither method employing lamps operating on reduced voltage has, to date, received official approval. They are, however, likely to be adapted inasmuch as they do the job on existing lighting equipment and thus conserve much of the labor and material required in the approved installation.

### LIGHTING IN A BUSINESS OFFICE

An important tool for the lighting of war-plant offices is found in the luminaire developed by the Utilities Research Commission of Chicago. The unit is not only low in cost and easy to install, but provides good brightness protection and uses a minimum of critical materials.

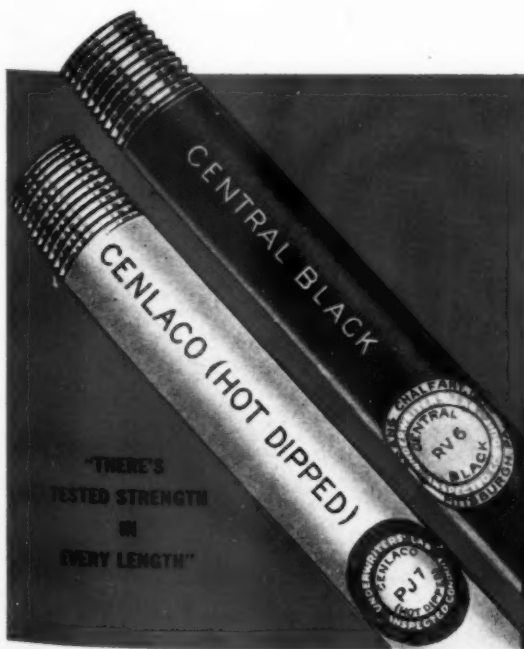
The accompanying photograph shows an installation of such units manufactured to the U.R.C. specifications by the Solar Light Company in one of the headquarters offices of the G-E Lamp



WHAT IF THE  
**POWER** failed HERE?

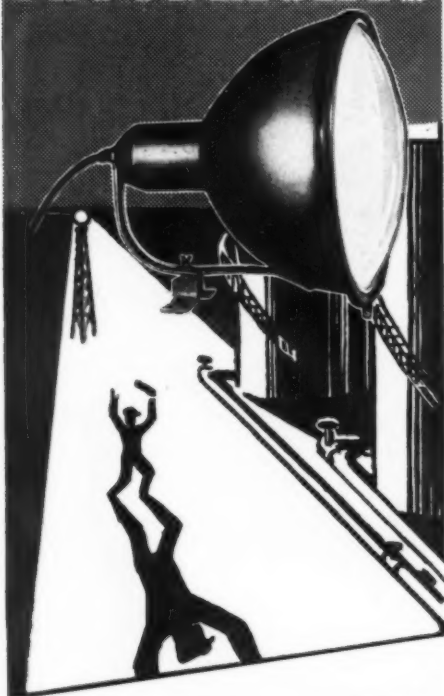
*Guard* VITAL CIRCUITS  
WITH  
**CENTRAL**  
RIGID STEEL  
**CONDUIT**

In the nation's great military and civil hospitals keen eyes guide the infinitely delicate movements of the surgeon's scalpel . . . a failure in power here may mean life or death. Wherever conduit is used, you can place full confidence in the rugged dependability and protection provided by CENTRAL RIGID STEEL CONDUIT. You'll appreciate, too, its consistent uniformity, accurate threading and easy workability—why electrical contractors everywhere prefer and rely on "Central."



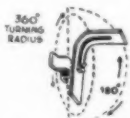
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# YOU CAN *Sell* COMPCO FLOODLIGHTS



## PROTECTION FOR PRODUCTION

It takes more than fences and plant police to keep out saboteurs. It takes CompcO Floodlights to bring out the hidden dangers that lurk in darkness. These powerful luminaires stop saboteurs from getting in...or make it mighty tough for them to swing into action if they do get in. Here's an item you can really sell—in quantity...and get them—on time!



ANOTHER  
**CompcO**  
QUALITY PRODUCT

Other CompcO products, well known for their high quality, enduring service and plus-value include fluorescent lighting fixtures, incandescent lighting fixtures and indoor floodlights for industrial and commercial use.

Full up and down adjustment in any radius at any point.

Available for better floodlighting with a baked-on white "plastic enamel" reflector and baked-on industrial grey outside finish. Three sizes. Write or wire for specification sheet and prices.



COMMERCIAL METAL PRODUCTS CO.  
2251 W. St. Paul Ave., Chicago, Ill.  
Phone Armitage 1123



[FROM PAGE 114]

Department at Nela Park. Two continuous rows of four 4-lamp luminaires provided 55 footcandles initially in this working area. The light desk tops also provide more comfortable seeing conditions.

The illumination level in this and similar offices also relighted with these luminaires have been more than trebled without entailing correspondingly large increases in wattage. The lamps used throughout this project were 40-watt daylight fluorescent lamps.



**TWO ROWS** of four diffusing units containing four 40-watt fluorescent lamps each trebled lighting without large increase in wattage.

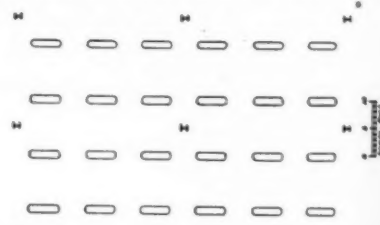
## Lighting A MACHINE TOOL FACTORY *Fluorescent*

**PROBLEM**—To provide a quality and quantity of general lighting that would give maximum visibility of all visual tasks on machine tools in this area.

**CONSTRUCTION DATA**—The area lighted is 90 by 350 feet, with a 15-foot ceiling, finished in flat white. Work consists of manufacturing precision parts for machine tools.

**SOLUTION OF PROBLEM**—General illumination is provided by two-lamp RF white porcelain enamel reflectors on 10 by 10-foot spacing at a mounting height of 13 feet. Each reflector is equipped with two 85-watt industrial white RF lamps which represents a load of 205 watts per fixture.

**RESULTS**—The average general illumination provided is 40 foot-candles in service.



**LAYOUT OF** rectified fluorescent units in this machine tool plant. Fixtures are installed on 10 by 10 foot centers.




















**HIGH LEVEL LIGHTING** from rectified fluorescent units spaced on 10 by 10 foot centers at 13 foot mounting height in a machine shop.



SOME HOMELY TRUTHS ABOUT



# HATS, HEAT and HORSEPOWER

SOMETIMES YOU SEE HATS  ON HORSES  ... NOT FOR FASHION,  BUT FOR A LITTLE PROTECTION AGAINST THE OPPRESSIVE HEAT OF THE SUMMER SUN  ... ELECTRICAL  HORSEPOWER NEEDS PROTECTION, TOO ... BUT IT NEEDS PROTECTION AGAINST DAMAGING HEAT CAUSED BY OVERLOADS  ... AND JAMMING ... AND OVERWORK ... AND VENTILATION FAILURE. WITH THERMOGUARD ON YOUR WESTINGHOUSE SMALL MOTOR  YOU'LL HAVE COMPLETE  PROTECTION AGAINST  OVER-HEATING FROM ANY CAUSE ... WHEN THE MOTOR TEMPERATURE BECOMES UNSAFE  THE BI-METAL DISC  SNAPS  OPEN ... BREAKING  THE CIRCUIT BEFORE ANY DAMAGE IS DONE ... THE DISC ON THE AUTOMATIC THERMO-GUARD SNAPS SHUT AGAIN  AS SOON AS THE MOTOR COOLS  TO A SAFE TEMPERATURE ... MANUAL THERMOGUARD MUST BE RESET BY PUSH BUTTON  ... TO PLAY SAFE, SHREWD MOTOR BUYERS SPECIFY—"WESTINGHOUSE"  ... TO GET EXTRA SAFETY, THEY ADD—WITH "THERMOGUARD"



## Westinghouse

SMALL MOTORS

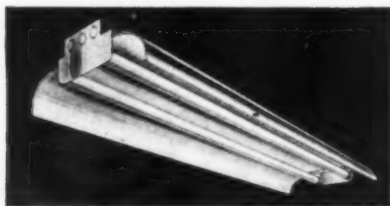


J-09171

# EQUIPMENT *News*

## Fluorescent Unit

This new industrial fluorescent lighting unit is called the Maze-Lite. The reflector is formed of sturdy pressed wood in lieu of steel. Available for two or three 40-watt lamps and two 100-watt lamps. The accessory housing is of steel and features side of channel starter switches for easy trouble-shooting and bump-proof end plates. For unit or continuous mounting, Maze-Lites can be attached to conduit or to chain-hanger. Edwin F. Guth Company, 2615 Washington Blvd.



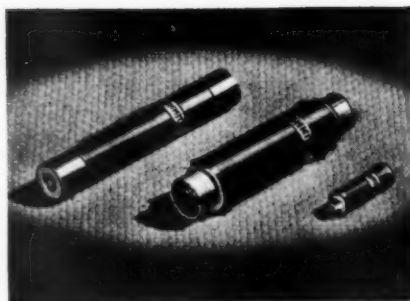
GUTH FLUORESCENT UNIT

## Street Light Shield

This new cone-shaped shield provides dim-out protection for street lights. It is designed to eliminate both direct and sky glow, which silhouettes cargo ships. The cone is made of non-critical weatherproofed material and is shaped to fit all series sockets. It is easily attached and permits use of lamp removers, if desired. General Electric Co., Schenectady, N. Y.



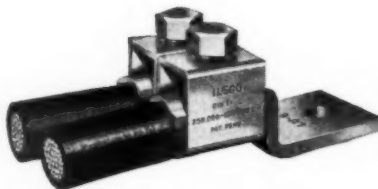
G-E STREET LIGHT SHIELD



OHMITE FERRULE RESISTORS

## Resistors

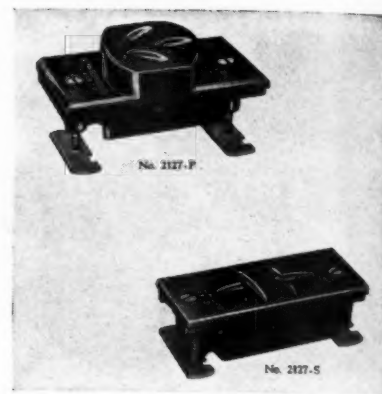
These ferrule resistors have been designed for easy interchangeability without the use of tools. An even winding of resistance wire on a ceramic core is protected by a vitreous enamel coating. The wire is terminated on metal bands or ferrules which permit mounting in fuse clips. Ferrules are cup, sleeve or cartridge type. The ferrule type of resistor is particularly applicable for use in the Navy, the Signal Corps, on Army aircraft and on railroads. Ohmite Manufacturing Company, 4635 Flournoy St., Chicago, Ill.



ILSCO SOLDERLESS CONNECTOR

## CONNECTORS

A new line of multiple solderless connectors has been announced. LU4 holds wires from 0 to 350,000 cm. and LU6 holds wires from 250,000 to 500,000 cm. No special tools are needed to make connections. Connectors have ample contact area to carry sustained overloads. Connectors are simple in design and make a neat installation of maximum efficiency. They have Underwriters Laboratories approval. IlSCO Copper Tube and Products Co., Mariemont, Ohio.



WIREMOLD RECEPTACLE

## Receptacle

Two new receptacles for installation in Wiremold No. 2100 "Plugmold" have been developed. The No. 2127P is a 3-wire polarized receptacle especially adapted for those installations where a solid ground is required for small tool motors. The No. 2127S Universal type is designed to take plugs with either parallel or tandem blades. Ratings are 10 amp. 250 volt; 15 amp. 125 volt. In industrial installations these new receptacles provide electrical service along work benches, work tables, inspection and assembly benches, where the use of portable electrical appliances and tools is necessary. The Wiremold Company, Hartford, Conn.

## Floodlight

These new floodlights are available for 3-way adjustable mounting. They are provided with heat resisting lenses insulated to prevent smoke, dust or rain from penetrating floodlight interior. Units can be installed so that they may be adjusted to almost any desired position. Available in all sizes from 200 to 1500 watt units. Units have a baked-on plastic enamel surface, inside and outside. Commercial Metal Products Company, 2255 W. St. Paul Ave., Chicago, Ill.



COMMERCIAL METAL FLOODLIGHT

# use emergency motor power NOW

... and save critical materials!



In peacetime, motors are designed with a substantial reserve safety factor. In other words, most applications are "overmotored" . . . the motors are capable of producing more horsepower than is required by the machines they drive.

Such "overmotoring" provides a reserve to take care of unexpectedly heavy loads, and assures long life with low maintenance cost.

But today, our problem is to "make the most of what we've got"—to get more production out of each and every motor—and to save critical materials.

Recognizing this fact, Westinghouse, at the suggestion of the War Production Board, now recommends that motor users modify their peacetime practices . . . that they get the most out of every motor they have . . . that in applying new motors or relocating old ones, they take advantage of all possible favorable operating conditions . . . that they load each motor to the limit.

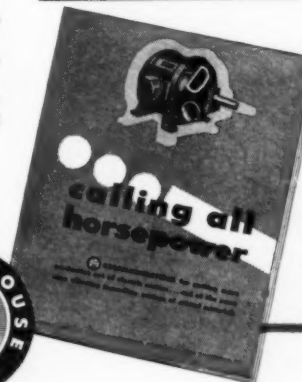
J-21255

## Westinghouse



for THIS LOAD	use THIS RATING	instead of THIS RATING	save these MATERIALS
hp	hp	hp	lbs.
1.25	1.	1.5	36
1.88	1.5	2.	14
3.75	3.	5.	19
6.25	5.	7.5	63
9.38	7.5	10.	80
25.	20.	25.	106
37.5	30.	40.	186
62.5	50.	60.	320
125.	100.	125.	550

Recommendations in this table apply to open-type A-C motors, 40°C rated, in applications seldom reaching or exceeding this temperature.



SEND FOR THIS BOOK

*Today* A summary of Westinghouse wartime motor recommendations is presented in the booklet "Calling All Horsepower."

Write today for your free copy. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.



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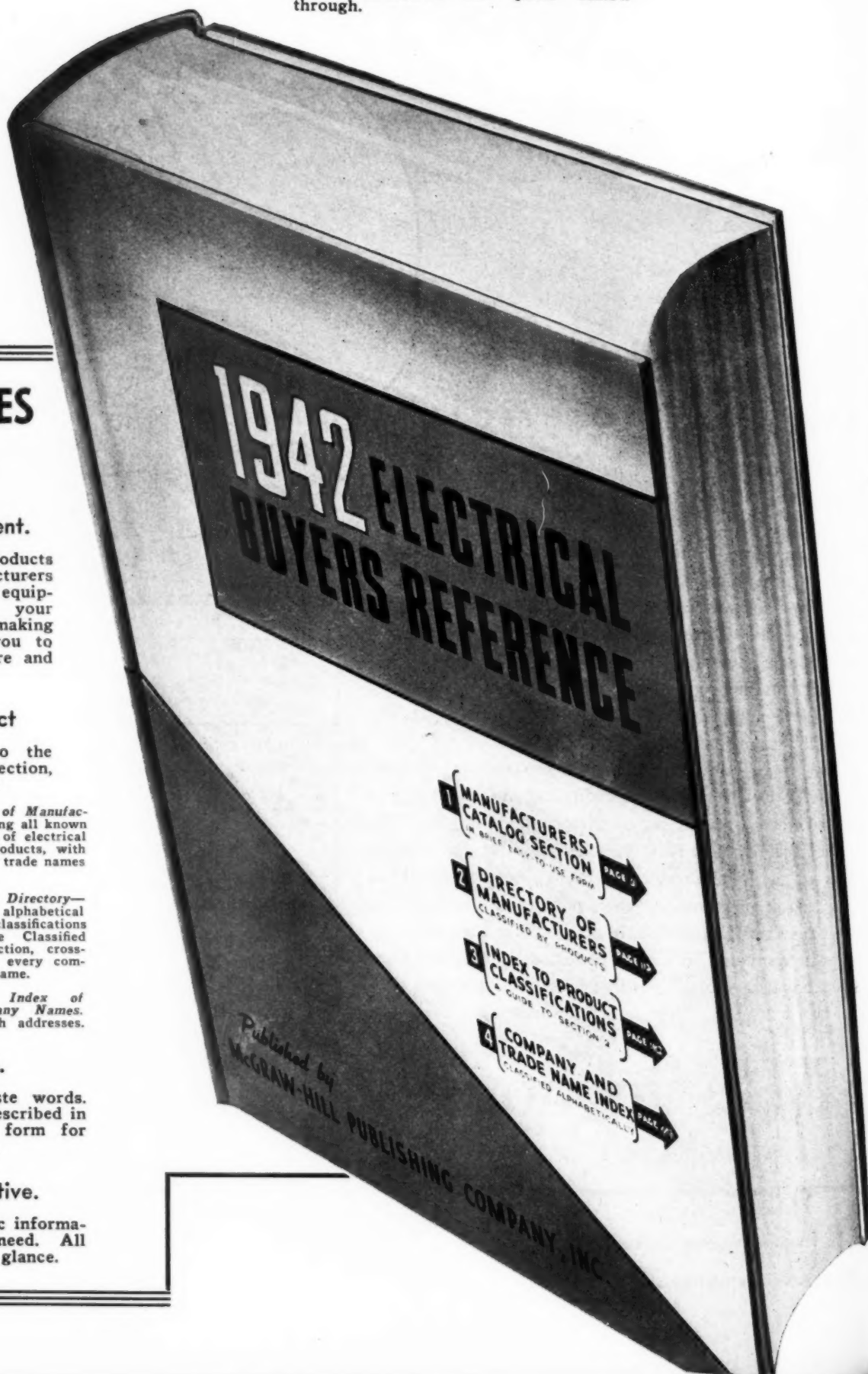
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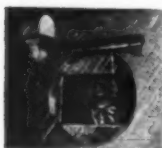
330 WEST 42nd STREET, NEW YORK, N. Y.



## THAT AID THE VISION OF OUR NAVY

When rain and sleet are driven by wintry blasts . . . when sea spray thrown by plunging bows dashes against protective glass . . . these are the times when the mariner needs the clearest of vision.

Electrically driven windshield wipers, developed for our Navy, are so powerful that they literally scrape ice off glass yet can be reduced in action to wipe away gently the slightest sea mist. Ward Leonard Rheostats are used in many of these jobs to control exactly the motive power of the wipers.



**PORTLIGHT TYPE WIPER.** Removes Sleet, Ice and Salt Deposits . . . and keeps going.

This is just another of the many instances where Ward Leonard Controls developed for peace time service meet a vital need in war activity. If your war work requires any form of electric control, you probably will find exactly what you want in the Ward Leonard Line.

### WARD LEONARD

Electric control  devices since 1892.

WARD LEONARD ELECTRIC COMPANY, 28 South Street, Mount Vernon, N. Y.



EQUIPMENT *News*

[FROM PAGE 118]

### Lighting Fixtures

Substitute materials have been used in this line of fluorescent industrial and commercial lighting fixtures to provide steel reductions up to 64.5 per cent. A reduction of 46.4 per cent in the steel used in the recessed troffer type fixture has been made. A saving of 59.5 per cent in steel has been made in the exposed type troffer. In the industrial field, substitute materials for reflectors has reduced the steel content of a typical fixture by 64.5 per cent. Where steel could not be eliminated entirely, the gauge has been reduced to a minimum, in order to cooperate with the War Production Board. DayBrite Lighting, Inc., 5411 Bulwer Avenue, St. Louis, Mo.



DAYBRITE INDUSTRIAL UNIT

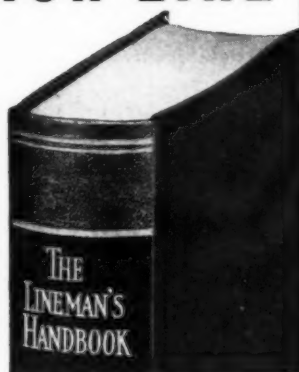
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No matter what it may be, you will find complete data in this practical handbook for linemen, foremen, and other employees of line departments. This big home-study and reference volume is filled with the facts you need in order to do quick, safe, efficient work.

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This handbook covers everything the practical man wants to know about every phase of transmission line work. It is a handy volume packed with workable plans, methods, kinks, short cuts, tables, diagrams, and photos, on every aspect of materials, poles, towers, stringing, guying, trouble-shooting, first aid, etc. Use it as thousands of other line department workers have—to check your methods against the practice of others, to get fast, dependable answers to problems that arise on the job, to brush up on special points, and for consistent study to improve your knowledge, grade and earnings.

#### 10 DAYS' FREE EXAMINATION

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Send me Kurtz—The Lineman's Handbook for 10 days' examination on approval. In 10 days I will send you \$4.00 plus few cents postage or return book postpaid. (Postage paid on cash orders.)

Name .....  
Address .....  
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Position .....  
Company ..... EC. 10-42

### Feeder Duct

A new low reactance feeder duct has been announced. It is designed primarily to serve as feeder between transformer banks and main switchboards or as feeders to branch circuits. It is also suitable for welder circuits. Saflex feeder duct provides balanced phases at all points because of a split-bus arrangement which provides electrical symmetry of the phases. The uniform low voltage drop is due to close spacing of the busses, separated by 1/4-in. of insulation. This duct is available in capacities from 500 to 6000 amperes, 600 volts or less for single phase, 2 and 3 phase and 3 phase, 4 wire services. Square D Company, 6060 Rivard St., Detroit, Mich.



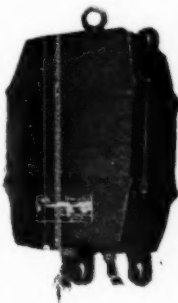
SQUARE D FEEDER DUCT



**RE VOLTAGE  
DON'T REWIRE**

**AND  
SAVE TIME  
AND MONEY**

In lots of plants, rapid expansion has increased the power and lighting load dangerously close to the carrying capacity of the wiring system. But don't re-wire. Step up the incoming voltage from 220 to 440 or 440 to 600 and thus automatically increase the ampere capacity of the wiring system. Then, by installing Acme Air-cooled transformers at motor locations, or department sections, voltage can be stepped down to power or lighting requirements. Saves time. Saves money. Saves copper. Saves labor. Acme Air-cooled transformers now up to 50KVA, 1 or 3 phase, 2400 volt primary. Better write for Acme Air-cooled Transformer Bulletin now.



## FLUORESCENT BALLAST

Those war production fluorescent fixtures with 4—100 watt lamps can now be operated with one ballast. This new Acme 4 lamp design provides balanced secondary voltage to 4—100 watt lamps and renders the same dependable performance that have made Acme Ballasts first choice in many important installations. For specifications, wiring diagrams, and operating features, write for Bulletin 157.

**THE ACME ELECTRIC & MFG. CO.**

36 Water St.

Cuba, New York

**Acme Electric**  
TRANSFORMERS

## Color Hoods

These color hoods are for use in interiors during blackouts. They provide a dim colored light without penetrating to the street. Full and half hoods are shells of natural colored glass which can be slipped over an ordinary light bulb. They have springs inside which hold them rigid to globe, either straight up or upside down. Can be supplied in various sizes in blue, green, amber, purple and canary colors. Lights covered with color hoods should be placed on a separate circuit so that when the principal lights are shut off for the blackout, the hood covered lamps will remain lighted. They are also used for warning and signal lights and can be equipped with flasher for blinking and coding. Reynolds Electric Company, 2650 W. Congress St., Chicago, Ill.



REYNOLDS COLOR HOOD

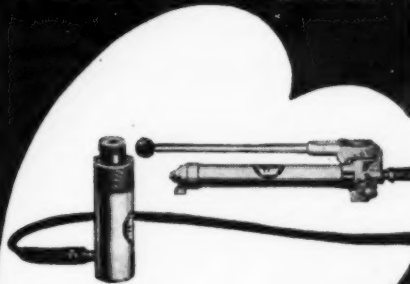
## Lamp Starter

A new "No Blink" fluorescent lamp starter, known as FS4-NA, is now available. Some of the features are—time-proven glow switch which starts the lamp on the first try. When a lamp becomes deactivated it is automatically cut out and all blinking and flickering is stopped. When a deactivated lamp is cut out, less than one watt current flows through the ballast so that overheating is prevented. When a new lamp is installed, the starter functions at once automatically. No cooling off period is required and there is nothing to reset manually. The Bryant Electric Company, Bridgeport, Conn.



BRYANT LAMP STARTER

## The HEART of a PIPE BENDER



is its  
**POWER UNIT!**

Pipe Benders have generally depended on hydraulic power from self-contained, "one-purpose" jacks that work only in limited positions. Blackhawk Benders are different — they have *Porto-Power Hydraulic Units*—hence, operation at any angle, light weight and extra utility. These same Porto-Power Units are widely used in many fields and are the only perfected equipment of their kind! Blackhawk is a specialist in building hydraulic equipment — and Porto-Powers are famous for their dependability, performance and freedom from maintenance.



Blackhawk Pipe Benders bend rigid conduit and pipe up to 4" diameter smoothly and without kinking. Save need for elbows, couplings, cutting and threading. Portable — lightweight — can be carried or rolled to the job and operated by one man to speed up construction and changeovers.

## MAIL COUPON TODAY

BLACKHAWK MFG. COMPANY

Dept. P20102, Milwaukee, Wis.

Send Full Information on your Pipe Benders.

Name.....

Company.....

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**"Here's a fitting  
made for  
MY convenience!"**



**"At any time, I can take out  
one fitting and put in an-  
other—without disturbing  
the conduit."**

**"If necessary, I can put in a  
new line of conduit before the  
fittings are delivered."**

**"I can do these things because  
every Kondu box is a union."**



**At ANY outlet of ANY  
Kondu fitting, you can use  
ANY kind of conduit—mak-  
ing either a threaded or  
threadless connection.**

Just insert the right bushing  
for what you want to do. Bush-  
ings are interchangeable—and  
low in cost. (This helps to  
keep down your fittings inven-  
tory.)

**100% re-usable . . . Kondu  
fittings are malleable iron,  
practically unbreakable . . .  
They give you a conduit line  
that's permanently tight, rigid,  
vibration-proof.**

*Write for the Kondu catalog.*

**KONDU CORPORATION**

**Erie, Pa.**

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**The Threadless Fitting Line  
of Unequalled Variety**

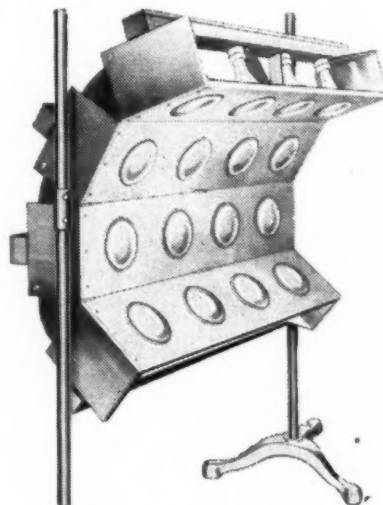


**EQUIPMENT News**

[FROM PAGE 123]

### Infra-Red Tunnel

A new infra-red drying tunnel has been announced. The overall operating efficiency of this tunnel is increased to maximum, through use of lamp shields, plus flexibility of adjustment of each lamp row, making it possible to change entire tunnel shape within three minutes time. It can operate with maximum efficiency on two or three dissimilar jobs in the same day requiring practically no change over time. These tunnels are designed so that additional rows can be added to tunnel sections and tunnel sections can be joined end to end for increased tunnel lengths. It uses R-40 reflector lamp. Wil-Son Mfg. Corp., Infra-Red Division 7, 154 West Erie St., Chicago, Ill.



WIL-SON INFRA-RED TUNNEL

### Ballast

A new 4-lamp ballast for fluorescent lighting in war plants has been announced. This ballast operates over a line voltage range of 250-280 volts and is applicable to circuits in the 265/460-volt-Y class. This means a reduction in copper requirements for plant lighting circuits. Compared with two 100-watt Tulamp ballasts, the new ballast requires 48 per cent less copper, 47 per cent less iron and steel and 50 percent less aluminum. Appreciable power savings also result—for a given installation electrical losses are cut 46 per cent. General Electric Co., Schenectady, N. Y.



G-E BALLAST

### MINERALLAC HANGER



**Conduit  $\frac{3}{8}$ "— $2\frac{1}{2}$ "  
Cable to  $2\frac{1}{8}$ " (with Bushings)**

**Cadmium and Everdur  
MINERALLAC JIFFY CLIP**



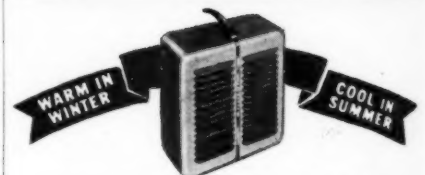
**Sizes from .250" O.D. Tubing  
to  $1\frac{1}{4}$ " conduit.**

**See your Jobber**

**New York City Office  
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**MINERALLAC ELECTRIC CO.  
25 N. Peoria St., CHICAGO**

**KEEP 'EM  
COMFORTABLE**



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EFFICIENCY**

**PORTABLE ELECTRIC HEATERS**

Watch production soar when you install Thermador Portable Electric Heaters. Enclosed fan forces out warmth or circulates cooling air. Light, compact, portable, may be moved about plant or office.

Equipped with four-position switch: cool, half heat, full heat, off. 8 foot cord, polarity plug. 230 Volts—50 or 60 cycles A.C., Single Phase. Sizes to 5000 Watts. Write for details.



**THERMADOR**

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# ROLL 'EM OUT... FASTER!

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TIMERS



900 Series

BE HONEST with yourself! Have you carefully studied how automatic time controls can help you "roll 'em out" faster... no matter whether you are making parts for guns, tanks, planes, ships or other products.

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...describing Industrial Timers, Time Switches and other Time Controls. Contains illustrations, construction and installation data, list prices and reference information.



PARAGON ELECTRIC COMPANY  
401 South Dearborn Street, Chicago, Illinois

**Paragon**  
BUILDERS OF  
CONTROL INSTRUMENTS  
SINCE 1905  
*Chicago*

## Fluorescent Lighting Fixtures

These fluorescent lighting fixtures, using a new method of ballasting to give instantaneous starting, are now available for industrial applications. With this method, the lamps come on fully at the turn of the switch. The conventional starting device is eliminated. Other features are positive starting at lower atmospheric temperatures and lower voltage, no radio interference. They are available for continuous or separate units, close to ceiling or suspended mounting, open reflector or louvered models. R & W Wiley, Inc., 777 Hertel Ave., Buffalo, N. Y.

## Socket

A new Woodwin No. 860 water tight socket is now available for marine work. It is made of a cold-molded composition, outside diameter 2 1/4-in., total depth without contacts 1 1/2-in. There are four holes around the top circumference through which the holding screws are placed. These holes are 2 1/4-in. center to center across the circumference of the socket. It takes a standard medium base Edison lamp, and meets specifications of the Maritime Commission. C. D. Wood Electric Co., Inc., 826 Broadway, New York, N. Y.



WOOD ELECTRIC SOCKET

## Secondary Protector

A new Thyrite secondary protector for use on current transformers to provide protection against high open-secondary-circuit voltages is announced. It consists of a disk of Thyrite connected across the transformer secondary terminals, together with thermostatically operated short-circuiting switch. In operation, when external secondary circuit becomes accidentally opened, secondary current will pass through Thyrite disk. When temperature of disk reaches approximately 100 C, thermostat operates switch to short circuit Thyrite and prevents damage by overheating. When temperature of disk drops to approximately 80 C, switch opens. This operation is repeated until normal conditions are restored to secondary circuit. Since protector is always parallel with transformer secondary winding, small amount of current will pass through protector under normal operating conditions. It can be used on current transformers which operate meters or relays. General Electric Co., Schenectady, N. Y.

# P&S

## WIRING DEVICES

## THE P&S- DESPARD LINE

Made to Order  
for  
Today's Market



## T-Rated Switches— Double Finger Grip Outlets — Pilots — Plates

Small size conserves critical raw materials and conserves shipping space—Compact combinations eliminate multi-gang boxes and plates—no lost time waiting for factory assembled combinations—Make your own right on the job.

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Send for Wiring Device Catalog

**Pass & Seymour, Inc.**  
SYRACUSE, N. Y.



# In the News

## LEAGUES SUPPORT WAR EFFORT

That the many and varied programs of electrical leagues are giving substantial aid to the nation's war effort was evidenced in five sessions of the International Association of Electrical League's seventh annual conference, held September 17-19 at the Hotel Cleveland, Cleveland, O., and attended by league managers from a score of cities, including San Diego, New Orleans and Minneapolis.

In welcoming the conferees, C. H. Christine, secretary-manager, St. Louis Electrical Board of Trade and I.A.E.L. president, declared that although the background of electrical league work covers some thirty years the impact of war has already introduced new responsibilities to the industry and the public and will create many new variables.

High praise was given the work of electrical leagues by Frank J. Ryan, assistant to the president, The Cleveland Electric Illuminating Co., who was introduced by J. E. North, president of the Electrical League of Cleveland. Mr. Ryan declared that "every town of 50,000 or more should have an electrical league." He stated that in Cleveland the league had "done most" to help that city's war effort.

Every phase of league wartime work, as related to the home, the commercial and industrial markets, wiring for wartime service, government regulations, membership, new programs and post-war planning, was discussed in detail during the general sessions. The morning session devoted to governmental regulations was addressed by T. P. Kelly, chief, Appliance Section, Consumer Durable Goods Price Branch, OPA; W. J. Shine, section chief, and S. W. Block, chief counsel, Service Trades Branch, OPA.

J. A. Morrison, managing director, Electrical Association of Philadelphia, was elected president of I.A.E.L. for the ensuing year at the business session which followed the conferences. Other officers elected were W. A. Ritt, secretary-manager, North Central Electrical Industries (Minneapolis), vice president; E. P. Zachman, business manager, Cincinnati Electrical Association, treasurer; and O. C. Small, who was re-appointed secretary. C. H. Christine will serve on the board of governor's in an advisory capacity.

## BLANKET AUTHORIZATION FOR MISCELLANEOUS WORK

Operators of industrial plants, office buildings, apartment houses, hotels and other substantial buildings have been granted permission by the War Production Board to apply for blanket authorization under L-41 to cover miscellaneous construction work over a period not to exceed six months.

Under the new plan all routinized individual construction jobs, except those estimated to cost more than \$5,000, may be included in applications for blanket authorization. In cases where authorization is granted, the applicant must file within two weeks after the expiration of each period of the term of the authorization a report covering the work done, its cost and the materials consumed. Form PD-200 should be used for all such applications and reports.

The application covering miscellaneous jobs should, if possible, set forth the proposed construction work within the stated period of time in terms of jobs, dollars and quantities of materials. A separate application must be submitted for each separate building or project.

Where it is impossible for the applicant to forecast the proposed jobs accurately, an application of a more general nature will be considered. However, the total cost of the proposed construction and a preliminary materials list must be included.

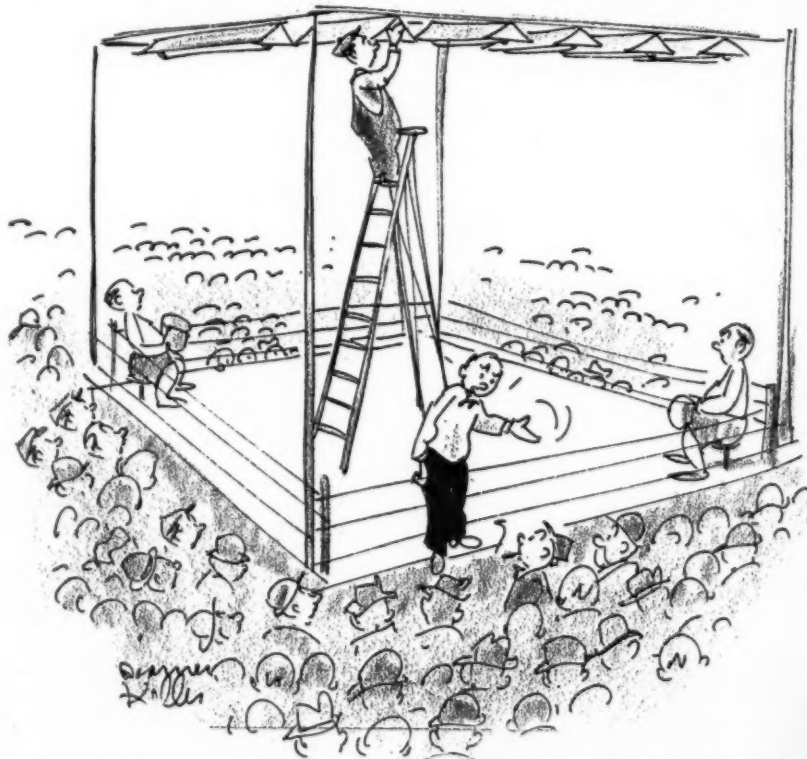
This plan is for blanket construction authorization only and does not alter the usual procedure for obtaining priorities assistance. However, when such assistance is required, this must be indicated on the blanket application.

Where priorities assistance for items of a single type only is required, applications on Form PD-1A will be accepted. If several different items are required, the applicant must apply on Form PD-200.

## CONSTRUCTION PRICE CEILING PLANNED

At a meeting in Washington on September 14th, representatives of the construction industry met with OPA officials to review a tentative price ceiling schedule for the industry. Two representatives of NECA and their counsel took part in the discussion.

The schedule discussed was titled Construction and Maintenance Services, and would set ceiling prices on lump sum con-



"Gosh, is he fussy—at the last minute we have to yank out the old lighting and install fluorescents!"

tracts by a formula based on (1) estimated cost of materials, (2) estimated labor cost at the July 1, 1942 levels, (3) equipment rental at cost, and (4) other direct expenses at actual cost. The margin would be established by the applicable percentage between the base dates Jan. 1939 to March 1942, with the most recent comparable project determining the maximum mark-up. Methods of price adjustment where estimated costs fall materially above or below actual costs would be included.

Following the meeting, the preliminary schedule was returned to price specialists for revision and formal release. No definite date has been announced. However, since the schedule under discussion appeared to be well beyond the preliminary draft stage, it was predicted that formal release would come within a few weeks.

### WARTIME RULES FOR THEATRE AND DOCK WIRING

Where the adoption of emergency wartime rules for electrical wiring is the responsibility of local state, county or city inspection bureaus having jurisdiction over electrical installations in their specific territories, rules are being revised to fit the practical problems created by material shortages. A. J. Newton, chief electrical inspector for the state of Washington has issued the following rules and standards for war emergency lighting in theatres and temporary wiring under docks. Emergency Theatre Lighting

1. A six-volt lighting system, operated by storage batteries made inaccessible to patrons, is accepted. Batteries not permitted in operating booth.
2. Knob-and-tube or non-metallic sheathed cable may be used.
3. All wiring within seven feet of the floor must be protected.
4. Conductors must be at least No. 12, rubber-covered.
5. Circuit loads must not exceed 50 watts.
6. Circuit fuses must not exceed 10 amperes.

#### Dock Wiring

1. Open wiring on porcelain knobs with rubber-covered wire of No. 12 gauge, supported every four feet and separated six inches, is permitted.
2. Circuits must not be over 150 volts to ground.
3. All wires must be run between joists and above pile caps, pipes, etc.
4. Rigid conduit must be used where wires run under joists, caps, pipes.
5. Where wires pass over caps, pipes, etc., they must be protected by porcelain tubes which extend at least 6-inches in each direction.
6. Weatherproof, keyless, moulded type sockets with taps not over 6-inches long, must be used.
7. Branch circuits are limited to 1650 watts, 20 sockets.
8. Branch circuit fuses are limited to 15 amperes, Type S.
9. Where highly explosive or inflammable liquids are stored or handled in other than their original containers, Article 500, N.E.C. must be followed.
10. The wiring and equipment must be removed within six months after the termination of the war.

## For Industrial Maintenance USE G-E SILVEND FUSES FLUORESCENT STARTERS



G-E Silvend Fuses will protect factory production. G-E Fluorescent Lamp Starters will provide longer lamp life and performance. Use both G-E Silvend Fuses and G-E Fluorescent Starters for the factories you service. Delays caused by power interruptions or too frequent lamp replacements will be avoided.

### G-E SILVEND FUSES

These fuses have silver-plated contacts. No matter how long they remain in cutouts having silver-plated contacts they maintain good contact . . . heating due to oxidation does not occur. Apparatus with silver-plated fuse contacts needs these fuses for best results.

### G-E FLUORESCENT STARTERS

G-E Fluorescent Starters accurately time the preheating of lamp electrodes before the starter switch opens. Wasteful attempts to start lamps too soon are not made. Starters are available for 15-, 20-, 30-, 40-, 65- and 100-watt lamps. A new "Master No Blink" Starter was recently introduced.

For further information see the nearest G-E Merchandise Distributor or write to Section D1021-8, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

# GENERAL ELECTRIC





[FROM PAGE 127]

## WILSON OF G.E. NAMED WPB VICE CHAIRMAN

Chairman Donald M. Nelson announced the appointment of Charles E. Wilson, President of the General Electric Company, as a Vice Chairman of the War Production Board on Sept. 18.

In this post, Mr. Wilson serves as Chairman of the newly-organized Production Executive Committee, and exercises the powers of the Chairman of the War Production Board in seeing to it that production programs are met.

"Mr. Wilson will be the top production authority in the war program and will have the responsibility of seeing to it that programs and schedules for all phases of our war effort are met," Mr. Nelson said. "I am glad that we have been able to enlist his services and I know that he will make a great contribution to the war program."

Mr. Nelson disclosed that he has formed the Production Executive Committee to bring together top officials in the War Production Board, the Army, the Army Air Corps, the Navy and the Maritime Commission to maintain a constant check and control on the production program. This committee will meet twice weekly, under the chairmanship of Mr. Wilson. Its other members will be: Lieut. Gen. Brehon B. Somervell, Commanding General, Services of Supply, U. S. Army; Major Gen. Oliver P. Echols, Commanding General, Material Command, Headquarters, Army Air Force; Vice Admiral Samuel M. Robinson, Director of Material and Procurement, U. S. Navy; Rear Admiral Howard L. Vickery, Vice Chairman, U. S. Maritime Commission.

President Roosevelt, in approving the appointment, said that he was very happy to know that Mr. Wilson had been given

a Vice Chairmanship of the War Production Board, and added: "I have always considered Mr. Wilson one of the ablest production executives in the country, and he has done an outstanding job in the production of war material."

Owen D. Young and Gerard Swope were requested by the Board of Directors of the General Electric Co. to resume their original responsibilities as Acting Chairman and President of the Company.

## BLACKOUT FIXTURES MUST MEET WAR SPECIFICATIONS

Manufacture or sale of blackout and dim-out lighting fixtures which do not conform to specifications of the War Department, Navy Department, and the Maritime Commission is prohibited by a new War Production Board order, effective September 18, 1942.

The order, L-168, also lays down conditions under which approved fixtures—street and highway lights, traffic signals, flashlights, lanterns and other equipment intended for use in blackouts and dim-outs—may be sold.

The principal function of blackout and dim-out lighting fixtures is to control sources of artificial light in order to prevent observation from the air, or to reduce the "sky glow" in coastal areas, while permitting emergency movement to continue on the ground.

Use of such fixtures in specific "target areas" is a precautionary military measure required by the War and Navy Departments. The War Department has issued specifications governing building, street, and highway lighting during blackouts, and is preparing specifications for coastal lighting and for blackout accessories for flashlights, lanterns, traffic signals, and other related lighting equipment.

Military specifications require a certain standard of optical and mechanical performance, but do not regulate the material content of the fixture. This control is established by the limitation order announced today.

Use of metals in the manufacture of approved fixtures is prohibited except, within the limitations of the steel and copper conservation orders (M-126 and M-9-c), for the minimum amounts of iron and steel required by the specifications, and the minimum quantities of brass and copper required to provide adequate electrical contact and conductivity.

Exemptions from the ban on manufacture of fixtures unapproved by the Services or Maritime Commission permit manufacture for the purpose of testing the conformity of the fixture with the specifications; manufacture as authorized by a proper military official in an emergency; and manufacture of the authorization of the Director General for Operations.

Sales are prohibited except:

1. For Army approved fixtures containing critical materials on A-1-k or higher rated orders, or on A-4 orders if no critical materials are involved.
2. Approved accessories for flash lights or approved lanterns may be sold to the



**CRITICAL INSPECTION** of their new headquarters has just been completed by (L to R) Ray Edenfield, president; and Hilliard Travis, manager, Edenfield Electric Co., Nashville, Tenn., electrical contractors. They now have the additional room that increased business demanded.

consumer without ratings if the Director General has approved the sale by the manufacturer, and approved the area in which the fixtures have been distributed.

3. For testing conformity without specifications.
4. By a proper military official in an emergency.
5. In fulfillment of Navy or Maritime Commission contracts for use on ships operated by or under the direction of those agencies.
6. If otherwise authorized by the Director General.

Manufacturers are required to file detailed reports with WPB within thirty days, and on the fifteenth day of each succeeding month, containing sketches or drawings of their plans and data on their inventories and sales of such equipment.

The order was developed by the Lighting and Fixtures Section of WPB in collaboration with the Engineer Board, Corps of Engineers, and Services of Supply of the Army; the Bureau of Ships and Bureau of Yards and Docks of the Navy; the Civil Aeronautics Administration; and the Office of Civilian Defense.

Copies of the War Department specifications are available on request at State and Local Defense Councils and the regional offices of the OCD.

## LAUNCH ENGINEERING COURSE

The Educational Committee of the Cook County Electrical Contractors Association, Chicago, is beginning its fall activities by sponsoring an "Engineering for Contractors" course for the benefit of its membership. This follows on the heels of a 20-week estimating course which started as a novel experiment last winter and ended as a huge success last spring—so successful, in fact, that the group clamored for more. This advanced course is the answer.

The new course starts October 15 and will continue for 28 consecutive weeks, there being one three-hour session each week. The schedule calls for

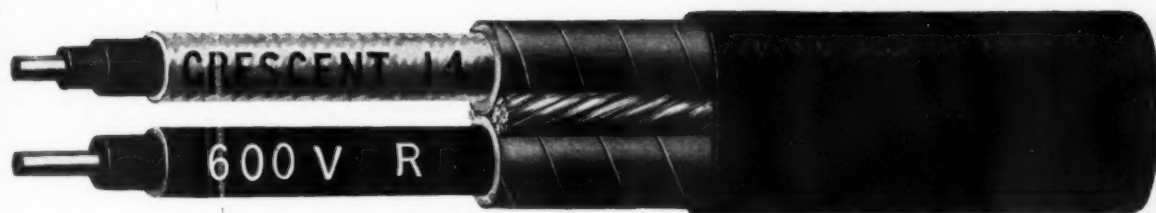


**DELIVERY DATES** and material problems are discussed in this huddle between R. M. Gurovitsch, sales manager, Northern Electric Supply Co., Duluth, Minn., and Irving O. Christopher, Belknap Electric Co., Superior, Wis., as they check over a job order.



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# CRESCENT



# CRESFLEX

## NON-METALLIC SHEATHED CABLE

For interior wiring of industrial plants, cantonments, war housing and where speed and ease of installation with readily available boxes and fittings is important.

Uses a minimum amount of rubber, as the white, neutral, grounded conductor employs time-tested, triple-braid, weatherproof insulation. Approved construction under National Electrical Code, Underwriters Laboratories and W.P.B. Regulations for operation at 600 volts AC on grounded neutral systems.

### CRESCENT INSULATED WIRE & CABLE CO.



CRESCENT ENDURITE SUPER-AGING INSULATION · WEATHER-PROOF WIRE

# How to design, install, and service fluorescent-lighting systems



**Just Published!**

A number of actual installations of many types, in factories, drafting rooms, offices, stores, homes, theaters, etc., are pictured in this practical manual, with brief data, to indicate the scope of fluorescent-lighting application and suggest means of meeting specific illuminating problems.

Make sure you get the extra profits promised by the growing popularity of fluorescent

lighting. Here is a practical manual covering the subject in all its aspects, presented so that anyone can understand it, with or without much electrical training. Gives the most authoritative information available on construction and performance of all types of fluorescent lamps, principles and methods of calculating illuminating requirements and designing luminaires and installations, pointers and methods of installing and maintaining fluorescent lamps and of locating and remedying their troubles. Includes working data, comparison of cost factors of fluorescent and incandescent lighting, etc.—

everything to aid in the designing, selling, installing, and servicing of efficient and satisfactory fluorescent-lighting systems.

## FLUORESCENT LIGHTING MANUAL

By CHARLES L. AMICK  
Nela Park Engineering Department  
General Electric Company

312 pages, 6 x 9, 217 illustrations many tables. \$3.00

*These 10 chapters give you  
a working knowledge of  
fluorescent lighting and  
its application*

1. The Fluorescent Lamp
2. Auxiliary Equipment
3. Operating Characteristics
4. Installation Hints
5. Service Suggestions
6. Luminaire Selection
7. Fluorescent-lighting Design
8. Color Quality
9. Fluorescent Applications
10. Lighting Economics

Besides giving a how-to-do-it cast to all information presented, the author emphasizes its meaning from the standpoint of answering doubts or questions regarding the value of using fluorescent lighting. From this book both newcomers in the lighting industry and more experienced readers will get an overall picture of every link in the fluorescent lighting chain and an appreciation of the importance of each, as well as instructions in the methods of design, installation, and servicing.

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Send me Amick—Fluorescent Lighting Manual for 10 days' examination on approval. In 10 days I will send \$3.00 plus few cents postage or return book postpaid. (We pay postage if you remit with order.)

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[FROM PAGE 128]

two 14-week periods, each one to deal with a definite phase of electrical construction engineering and estimating of an advanced nature.

During the first period the contractors will work on industrial installation problems, starting practically from scratch. They will be given plans showing only equipment and outlet locations and will have to design and estimate the entire installation. Then they will check their designs with the instructor's and find out where and why they made errors. The remainder of the first period will be devoted to the study, design and estimating of electrical work on government type of projects—airports, barracks and other types of buildings and structures. Knob and tube, non-metallic sheathed cable and conduit systems will be studied and designed. The contractors will learn how, where and why each system should be used. Estimating such systems will also be covered.

The second period of 14-weeks will be devoted to the study, design and estimating of signal systems, low tension systems, motor control and hook-up. Essentially the same method of attack will be used as in the first period.

About 25 to 30 contractors are slated to take the course and like the last time each one will have to dig down in his jeans—only a little deeper this time. Tuition will come to \$35 per person, which isn't much when stretched over 28 weeks. Ralph H. Decker, consulting electrical engineer and estimator of Chicago who conducted the previous courses, will be the instructor. The Educational Committee of the contractors organization is comprised of Ted Hankins, chairman, Elton Gould and Frank Block.

### COPPER REQUISITION SPEEDS DISTRIBUTION

Immobilized stocks of a copper in idle and excess inventories are being requisitioned to fill emergency needs at the rate of over 4,000,000 pounds a week, according to an announcement by E. A. Tupper, Chief of WPB's Inventory and Requisitioning Branch. More than half of all emergency requests are being filled from this source, it was said.

An example cited was an order on the Howard P. Foley Company, electrical contractors, to complete work on a Philadelphia armor plate plant four months ahead of schedule. They required 52,000 pounds of cable and busbar which was not scheduled from the regular suppliers for 90 days. They placed their problem before the Copper Recovery Corporation, and within 24 hours all but 2000 pounds of the material was located in the inventories of companies in five different states. Sales were arranged and the needed copper delivered.

## SIMPLIFICATION ORDER CUTS LAMP TYPES

Less than half of the various types of electric light bulbs and lamps currently produced will be manufactured after November 1 under terms of a simplification order announced by the WPB.

Moving to conserve materials and production capacity in the incandescent and fluorescent lamp industry, the WPB ordered that types of bulbs now made be reduced from 3500 to 1700. The cut will be accomplished through elimination of almost 2000 lamps of varying voltage, wattage, color, and other construction specifications.

There will be no curtailment in the total production of electric bulbs as a result of this action. It is expected that adequate supplies of the permitted types will be produced to compensate for those which will no longer be made.

The order, L-28-a, calls for elimination of some types of bulbs in all categories of incandescent, fluorescent and glow discharge lamps. These include household bulbs, industrial lamps, searchlights, railroad signal lamps, auto headlights, beacons, and a long list of other types which cover practically every kind of electric lamp and bulb now produced.

In issuing the order, the Consumer's Durable Goods Branch of WPB pointed out that it was guided by several criteria in determining which type of lamp should be eliminated.

Primarily, those bulbs for which suitable substitutes are available will no longer be made. Lamps for which there is no essential demand are now discontinued.

Lamps which had been made in a great variety of different voltages and wattages are now simplified so that only a fraction of the previously made types will be required.

As a practical example of how the order will operate, the common household electric light bulb previously made in voltages of 110, 115, 120, 125 and 130 will now be made only in the 115, 120 and 125 volt types. Likewise, 50 watt and 75 watt lamps will no longer be made because lamps in wattages of 15, 25, 40, 60 and 100 are satisfactory.

Colors used for lamps have been greatly simplified by the order. Only bulbs in red, blue, and green will be allowed, as compared to the large number of color variations used previously.

In a schedule appended to the order, specifications for the lamps now permitted to be produced are listed. The only exception to the specifications are lamps designed for diagnostic and surgical purposes and those produced for the Army, Navy, Maritime Commission, War Shipping Administration and Lend-Lease purposes. Even lamps for military uses cannot be made, however, if any type listed on the schedule can serve the same purpose.

The order prohibits, after November, etching, coating or marking of bulbs for private accounts such as schools, railroads, clubs, etc., or for other resale purposes. This means that the only persons who can etch, coat or otherwise mark bulbs are (1) manufacturers who put their own or another manufacturer's trade mark or other identification on the bulb, or (2)

those who will use the bulbs for their own purposes. The effect of this provision will be to prevent such practices as individuals purchasing bulbs in large quantities, coating them, and then reselling them for blackout or decorative purposes. Likewise, no bulb may be etched with individual insignias or coat of arms unless the person who uses the bulb puts them on.

The order is expected to result in considerable savings in materials, manpower, manufacturing facilities, and storage space. It is estimated that 7 per cent of the materials now consumed will be saved. This will include 650 tons of steel, 35,000 pounds of solder, and 8,000 pounds of tungsten.

## PROMOTES INDUSTRIAL WORKERS COURSES

H. P. Wilson, secretary-manager, Electrical Institute of the Tri-Cities, is doing a lot of leg work contacting industrials in that area. He is now acting in an administrative capacity in organizing classes for the engineering, science and war training courses offered by the University Extension Div., University of Illinois.

Mr. Wilson's duties include making a survey of some 50 industrial plants to discover the interest shown in such classes. The results of the survey will determine how many of the 50 available courses should be given in that particular area. He reports that a minimum of some 1500 workers have expressed interest in the plan and that many more will undoubtedly fall in line as the canvass progresses. Once the courses have been definitely chosen he will have the task of supervising the classes, interviewing and registering the "students" and obtaining the local instructors.

## COMING MEETINGS

**International Association of Electrical Inspectors**—Western Section, Book-Cadillac Hotel, Detroit, Mich., Oct. 5-7. Eastern Section, Hotel Taft, New Haven, Conn., Oct. 12-14. Southern Section, Richmond, Va., Oct. 19-21.

**National Electrical Manufacturers Association**—Annual Meeting, Waldorf-Astoria Hotel, New York, N. Y., Oct. 26-30.

## WPB SPONSORS LIGHTING CONFERENCES

What appears to be one of the first WPB sponsored lighting conferences was launched Sept. 17 at Chicago, where the regional office of WPB is using the staff and facilities of the Chicago Lighting Institute to show plant executives the importance of good lighting.

Thomas N. Wynne, manager, Production Branch, WPB, Chicago, was quick to accept the offer of Carl Zersen, Lighting Institute manager, to help organize and stage this series of conferences, which is directed primarily to plant managers. Top-flight men in the lighting field will be on hand to present all phases of lighting as applied to industrial production.

The program for the first four sessions, the first of which was chairmanned

## Every turn of this P-A-X dial



## saves WAR PRODUCTION time

Here is action—not delay. Here is the quick twirl of the P-A-X dial that replaces walking and waiting for information. Here is the efficient way to transmit questions and answers in any plant determined to "beat the promise."

P-A-X—the automatic interior telephone system—permits executives and department head to stay at their posts where they can be most effective, yet enables them to talk instantly with others. Messages vital to faster production go through without delay or error. Co-ordination is improved.

## ELECTRICAL CONTRACTORS

—many of your customers are engaged in important war work. The ability of P-A-X to speed up their production may enable us to supply them. Ask your electrical wholesaler to work with you in presenting the P-A-X story; or write us direct.

# AUTOMATIC ELECTRIC



Private Interior Telephone Systems

Distributed by:

American Automatic Electric Sales Company  
1033 W. Van Buren Street, Chicago, Ill.  
Sales and Service Offices in Principal Cities

In Canada:

Canadian Telephone & Supplies, Ltd.,  
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## RELAYS CONTACTORS

A NEW CATALOG FOLDER  
on  
A NEW LINE OF RELAYS  
FOR INDUSTRIAL  
and  
GENERAL PURPOSE  
APPLICATIONS

Single, Double, and Multiple  
Pole

Alternating and Direct  
Current

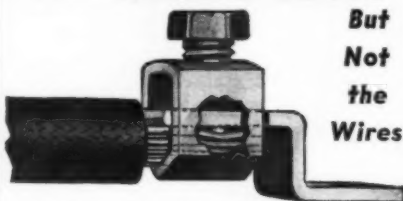
7 to 400 Amperes Per Pole  
Capacity

Custom-Built Types to  
Specifications

**AUTOMATIC**  
Electric Manufacturing Co.  
Mankato • Minnesota

**ILSCO**  
Electrical Connectors

**CUT WIRING COSTS**



But  
Not  
the  
Wires

**IlSCO SINGLE HOLE  
SOLDERLESS LUGS**

A MPLE contact area for sustained over-  
loads . . . an important feature when  
every man and machine is carrying  
overloads constantly. No special tools  
required. Serrations on collar and tongue  
exert maximum pressure. Pure copper of  
highest conductivity only  
is used. No extra weight  
or bulk.

MAIL THIS  
COUPON  
TODAY

Please rush us sample and illustrated  
32-page catalog.

FIRM NAME.....  
NAME.....  
ADDRESS.....

**ILSCO** MARIEMONT, OHIO  
COPPER TUBE & PRODUCTS, INC.

*In the News*

[FROM PAGE 131]

by Mr. Wynne, include the following  
topics and speakers:

- Sept. 17 Protective Lighting—A. G.  
Ottenheimer, G. E. Co.  
Prevention of Sabotage—  
A. H. Belmont, F.B.I.
- Sept. 24 Getting Best Results from  
Present Lighting Systems—  
John Harrington, Common-  
wealth Edison Co.—David  
Wood, Public Service Co.,  
of Northern Illinois
- Oct. 1 Infra Red Sources and their  
Industrial Applications—  
E. D. Tillson, Common-  
wealth Edison Co.
- Oct. 8 Correcting Lighting Faults  
to Speed Production—  
L. V. James, G. E. Co.,  
and the Chicago Lighting  
Institute

Details of additional conferences are  
still being formulated and subjects dis-  
cussed will cover means of increasing  
war production through the care and  
maintenance of the plant electrical sys-  
tem. Details of each conference will be  
announced in the weekly news bulletin  
War Production News.

### M-136 ADDS POLE HARDWARE

Amendment No. 1. to Maximum Price  
Regulation No. 136 as amended makes  
several minor changes to define the cover-  
age of the regulation. Under Appendix  
B, pole line hardware, line construction  
specialties and glass insulators have been  
listed. Electric wire, cable and cable ac-  
cessories, have been removed from Ap-  
pendix A. A new amendment to Price  
Schedule No. 82 now covers distributors  
as well as manufacturers of wire and  
cable.

Another change defines second hand  
machines and parts simply as those which  
have been "used". Items "purchased for  
use" but never "used" are no longer gov-  
erned by the provisions for second hand  
machinery.

### INDIANAPOLIS CONTRACTORS AID O.C.D.

The electrical contractors division of the  
Electric League of Indianapolis, Inc., is  
pitching in to help with the civilian defense  
problem. They are rapidly learning demoli-  
tion work and will be ready to take over  
this task in the event of an air raid or  
sabotage emergency anywhere in that city.

At the request of the Civilian Defense  
Council of Indianapolis, the League has  
undertaken the job of furnishing the per-  
sonnel of the Demolition Squads whose

duties will be to handle emergencies that  
might follow any bombing or sabotage.  
These include establishing temporary elec-  
trical service, restoring interrupted service,  
removing hazardous electrical conditions  
and other relevant duties. The League  
turned to the branch best qualified to do  
this service—the contractor division—and  
the response was more than gratifying.

Forty-four contractors answered a ques-  
tionnaire pledge offering their services as  
an Emergency Electrical Demolition  
Worker and listing the tools, trucks and  
equipment that each had available and  
where it could be obtained in case of an  
emergency. They also listed the particular  
types of electrical work in which they  
were best qualified; also their company  
and home addresses and telephone num-  
bers. This information is on file at the  
League office and provides a quick refer-  
ence in case of an emergency.

The contractors will work under the  
direction of George Popp, City Building  
Commissioner, who has been put in com-  
plete charge of demolition work. They  
have taken a 10-week special Defense  
Course which terminated on Sept. 28.

### WISCONSIN ADOPTS EMERGENCY CODE

The Wisconsin Industrial Commis-  
sion recently announced the approval  
of an emergency electrical code which  
becomes effective Sept. 27, 1942 and  
will remain in effect for the duration  
of the war and a period of six months  
thereafter, unless it is otherwise  
amended or repealed.

The emergency code permits the use  
of approved substitute electrical wiring  
materials and methods. Lists of the  
substitute materials and methods will be  
issued by the Electrical Code Advisory  
Committee of the Industrial Commission  
as they are needed.

### WAR HOUSING SHOWS DECLINE

War housing construction during July  
showed a marked decline from July of  
last year, according to an announcement  
by A. H. Ferguson, Federal Housing Com-  
missioner.

A total of 11,573 new houses were start-  
ed under FHA inspection in July 1942 as  
compared with 25,594 in July 1941.

### K. C. LEAGUE 30 YEARS OLD

October marks the thirtieth anni-  
versary of The Electric Association of  
Kansas City which started as the Elec-  
tric Club way back in 1912 with Frank  
Bernardin as president. During these  
years the group has conducted almost  
every kind of cooperative activity in-  
cluding, shows, exhibits, campaigns, leg-

## KNOW ELECTRICITY AS EXPERTS KNOW IT



## -AND GET AN EXPERT'S PAY

What about your future? Who is safe today? Surely not the man who is contented to stand still! Know your job thoroughly—prepare yourself for jobs ahead. To do just this thousands of men have used

## The CROFT Library of Practical Electricity

7 Volumes, 2906 pages

1948 how-to-do-it illustrations

● The Croft Library is a complete electrical educator. It is founded on practice—on 20 years of shirt-sleeve experience—on work as it is actually done. It is jammed from cover to cover with the kind of hardheaded facts you want. Written so that the beginner can easily understand it, yet so sound, so thorough, that it is the daily guide of 59,000 highly paid electrical workers and engineers.

● Croft tells you the things you need to know about motors, generators, armatures, commutators, transformers, circuits, switchboards, distribution systems—electrical machinery of every type—illumination in its every phase—the most improved methods of lighting—lamps and lamp effects, etc.—how to do a complete job, from planning it, to completion.

### NO MONEY DOWN

### EASY PAYMENTS

### 10 DAYS' FREE EXAMINATION

Fill in and mail the coupon below and we will send you the entire set of seven volumes for ten days examination on approval. We will take all the risk—you assume no obligation. If you decide to keep the books, send \$3.00 in ten days and the balance at the rate of \$3.00 a month.

### SEND THE COUPON NOW AND SEE THE BOOKS FOR YOURSELF

### EXAMINATION COUPON

McGRAW-HILL BOOK CO.  
330 W. 42nd St., New York

You may send me the seven volumes of the Croft Library of Practical Electricity for 10 days' examination. I agree to return the books, postpaid, in ten days or remit \$3.00 then and \$3.00 a month until the special price of \$18.00 has been paid.

(To insure prompt shipment, write plainly and fill in all lines.)

Name .....

Home Address .....

City and State .....

Position .....

Name of Company.....E.C. 10-42

isolation, cooperation with other city groups, and the development of a valuable industry spirit of working together.

October 1 also marks the 19th anniversary of Jerry Weston's association with the group. Jerry has the record of more than doubling the membership, bringing its present total up to 350 members.

### HACK-SAW BLADES ON A-9 RATING

Under order No. E-7, the War Production Board has limited the sale and distribution of metal cutting hack-saw blades to transactions carrying a preference rating of A-9 or higher.

### COMMUNICATION LINES TO BE BUILT

An overhead line project of "great magnitude" will be constructed under the direction of the Army Signal Corps according to a recent announcement by the Department of Agriculture. A similarity in construction with REA projects is indicated by the report that twelve engineers from the REA staff have volunteered to assist on the job. The Signal Corps has accepted REA's recommendation of a contractor fitted by experience to undertake a project of this size, it was said. The report, however, did not name the contractor.

### HAILE HEADS CHATTANOOGA LEAGUE

Herbert Haile, president of the Tennessee Electrical Contractors Association, took on added responsibilities recently when he was elected president of the Electric League of Chattanooga, Tenn. Further evidence of the interest and support given the League by Chattanooga contractors is in the choice of L. A. Ragon as second vice-president of the group.

Other newly elected officers of the League include Paul Ramsey, first vice-president; Paul J. McMillan, secretary; and J. W. Johnson, treasurer. Tom McAfee is the retiring president.

### BOOK REVIEWS

#### Arc Welding Handbook

The recently published seventh edition of the Procedure Handbook of Arc Welding Design and Practice should be a welcome addition to the technical library of anyone interested in the arc welding field. The Handbook is designed to give the student as well as the experienced welder a ready reference of basic information on arc welding in its present status. A complete description of arc welding in its various forms is presented together with essential data on its use for welding vari-

# McGILL



## Wood-Handle Guards



4675

McGILL No. 4675 Wood-Handle unit. Made of best-grade steel wire; Hook and Cage, copper-plated. Durable, polished, hardwood handle. Furnished with McGILL Leveller socket.



Series  
8000

Popular McGILL No. 8000 Portable Wood-Handle Guard for all-purpose requirements. Construction relieves strain on cord and socket connections. Ten extra-heavy, Bessemer steel wires, electrically welded, cadmium-alloy-plated cages.

McGILL Wood-Handle Guards are providing protection in heavy-duty defense industries. Increased use of wood handles proves their satisfaction as substitutes for rubber. Wood-Handle Guards are sturdy, wash easily without injuring wood handles. For further information visit your wholesaler or write to us.

Electrical Division



VALPARAISO, INDIANA





## "Praise the Lord and Pass the Ammunition"

**THIS** Pearl Harborism,\* uttered by a fervent Navy chaplain, will live in our school books long after today's headlines and swaying battle lines have passed into history.

It exactly expresses the unique combination of the spiritual and the practical which is inherent in our national character.

... And America IS passing the ammunition. Starting with an atrophied military explosives industry in 1939, the Production for Defense program had raised the rate of "passing the ammunition" by 1400% at the time the chaplain spoke.

► Since then, according to an official statement of Donald Nelson:

"Explosives and ammunition are being made at many times the rate of last year as newly constructed plants come into operation. TNT is being made at a rate five times that before Pearl Harbor. Smokeless powder is being produced at a rate almost twice that before Pearl Harbor. One new plant is making more TNT today than the entire explosives industry produced in peacetime and there are several of this type of plant."

Incendiary bombs are vital ammunition in the kind of war we are in. America's chemical industry is far ahead of schedule in passing along that potent ammunition.

Magnesium is part ammunition, part construction material. You know it's now being taken from sea-water, but do you know that we are making at least 100 times as much magnesium now as we did in 1938?

100-octane gasoline isn't ammunition, but it's handy to have around in a war, because bombers using this product of American chemistry can carry an extra ton of what it takes to win.

Synthetic rubber is another necessity in passing the ammunition. The Chemical Industry faces the staggering job of producing more rubber than all the rubber trees in the world were able to pour into the American market prior to the war... 875,000 tons per year by 1944 is the goal. Those of us who have seen tank-factories and ship

yards grow faster than the corn-crops they replaced believe the Chemical Engineers of America will do the job.

What is the secret of these amazing modern counter-parts of the frontiersman's ability to turn from peace to war?

► One of the important answers is Chemical Engineering. We just naturally have more men and more machines that know how to make a molecule behave than any two nations on earth.

Starting after World War I, our chemical engineers used the experience gained in guncotton factories to develop the vast peacetime Chemical Industry which gave you rayon, lacquer, transparent wrapping paper, plastic telephones, knockless gasoline, shatterproof glass, synthetic vitamins, laboratory-fathered medicines, plastic tips for your shoe laces, nylon hosiery, and thousands of other comforts to help you live a peacetime Life of Riley.

This vast activity of making life more livable for peaceful Americans had created an enormous pool of management and production men in our chemical industries.

When war came, these men answered their country's call, by rearranging their peaceful atoms into bellicose molecules that would explode, fly, float, shoot or stop a bullet.

Today, fertilizer, salt, whiskey, rayon, even pine stumps are being turned into products of unrecognizable ferocity.

► When the war is over, it will be the imagination of the Men of Chemistry that will set our great new war-chemical plants upon a new era of peacetime fruitfulness. Even while the chemical engineer is breaking production records for war, he is planning for a peacetime production that will revert these molecules toward serving our daily lives. Chemical Warfare will become Chemical Welfare, through Imagination.

★ ★ ★

In recognition of the miracle of war production—accomplished through the cooperation of American management and labor with the W.P.B. . . . this 7th in a series of newspaper advertisements is published by the McGraw-Hill Network of Industrial Communication.

\*Also title of Gene Lockhart's famous fighting song of World War II

**McGRAW-HILL PUBLISHING COMPANY, Inc.**

330 WEST 42ND STREET

NEW YORK



← This advertisement appears  
in a group of newspapers on  
Wednesday, September 9, 1942

## . . . . and pass the INFORMATION

**W**HEN an American gunner calls for ammunition, whether he wears a cross—like the chaplain in our newspaper advertisement—or a tattooed mermaid, he sets in motion the mightiest war-machine on earth . . . American Industry.

Knitting together all the industries of America, making it possible for them to turn *quickly* from peace to war, is the Industrial Press.

When the gunner yells for **AMMUNITION**, industry yells for **INFORMATION**. It is the job of the industrial magazines to supply it.

"What do we do when we can't get stainless steel for a Toluol recovery plant?"

"Which is the best section of the country for locating our new plant, considering power supply, bombing range and transportation?"

"How can we step-up the alcohol output of our stills, without using scarce metals?"

"What's the best method of training 18,000 green hands to get quick operating efficiency?"

These are typical of the questions that flow over the desks of our editors day after day.

They keep nearly 900 McGraw-Hill editors and engineer-correspondents busy, making field calls, finding the best answer to each problem

and reporting the results to management and production men.

Industrial advertisers supplement this work by showing how their products meet specific needs.

This constant interchange of information is part of the strength and adaptability of American Industry.

It is so important that executives are surveying their organizations to make sure that the supply of Industrial Magazines is adequate.

If you would like suggestions as to how to conduct such a survey, write to The Reading Counselor, McGraw-Hill Publishing Company, Inc.

★ ★ ★

### THE MCGRAW-HILL NETWORK

23 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents . . . More than 1,000,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

### THE MCGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

**MCGRAW-HILL PUBLISHING COMPANY, Inc.**  
330 WEST 42nd STREET • NEW YORK

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### THE MCGRAW-HILL NETWORK OF INDUSTRIAL PUBLICATIONS

American Machinist	Coal Age	Electronics	Mill Supplies
Aviation	Construction Methods	Engineering & Mining Journal	Power
Bus Transportation	Electrical Contracting	E. & M. J. Metal and Mineral Markets	Product Engineering
Business Week	Electrical Merchandising	Engineering News-Record	Textile World
Chemical & Metallurgical	Electrical West	Factory Management & Maintenance	Transit Journal
Engineering	Electrical World	Food Industries	Wholesaler's Salesman

# SEARCHLIGHT SECTION

(Classified Advertising)

**EMPLOYMENT : " OPPORTUNITIES " : EQUIPMENT**  
**BUSINESS : (Used or Resale)**

UNDISPLAYED

RATES

DISPLAYED

15 CENTS A WORD. MINIMUM CHARGE \$3.00  
 Positions Wanted (full or part time salaried employment only), 1/2 the above rates payable in advance.

**Box Numbers**—Care of publication New York, Chicago or San Francisco offices as 10 words.  
 Discount of 10% if full payment is made in advance for 4 consecutive insertions.

NEW ADVERTISEMENTS received by October 22nd will appear in the November issue, subject to limitations of space available.

The advertising rate is \$7.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured 1/4" vertically on one column, 3 columns—3 1/4 inches—to a page. Individual Spaces with border rules for prominent display of advertisements.

## FOR IMMEDIATE DELIVERY!

### Used Electrical Equipment

#### ALL TYPES AND SIZES

- |                            |                                    |
|----------------------------|------------------------------------|
| 17 Ammeters                | 200 Wattmeters & Watt Hour Meters  |
| 12 Regulators              | 74 Cut Outs—Oil Type               |
| 300 Disconnecting Switches | 46 St. Ltg. Transformers—Type I.L. |
| 250 Bus Supports           | 40 Oil Circuit Breakers            |
| 150 Current Transformers   | 15 Police Telephones               |
| 7 Potential Transformers   |                                    |

Other Miscellaneous Items

Write TODAY for listing of  
 Complete Inventory and Prices

**DEPT. OF UTILITIES, 920 Park St., Alameda, Calif.**

**WE BUY AND SELL**  
**MOTORS**  
**TRANSFORMERS**  
**MOTOR GEN. SETS**  
**OIL SWITCHES**  
**AIR CIRCUIT BREAKERS**  
**ELECTRIC EQUIPMENT CO.**  
 678 Lake Ave., Rochester, N. Y.  
 Tel: Glenwood 6783

#### POSITION VACANT

ELECTRIC MOTOR repairshop Foreman, Motor Assemblers and armature winders, by an Ohio repair shop. Must be draft exempt and not employed on defense work. P-36, Electrical Contracting, 520 N. Michigan Ave., Chicago, Ill.

#### WANTED

ONE FRACTIONAL H.P. Motor test bench with Dynamometer and other equipment used in the repair of Electric Motors. W-35, Electrical Contracting, 520 N. Michigan Ave., Chicago, Ill.

ANYTHING within reason that is wanted in the field served by Electrical Contracting can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

## Prompt ANSWERS to business problems . . .

MISCELLANEOUS business problems are daily being solved quickly and easily by the use of the Searchlight (classified advertising) Section of this and other McGraw-Hill publications.

When you want additional employees, want to buy or sell used or surplus new equipment, want additional products to manufacture, seek additional capital, or have other business wants—advertise them in the Searchlight Section for quick, profitable results!

American Machinist	Electronics
Aviation	Eng. & Min. Jour.
Business Week	Eng. News-Record
Bus Transportation	E. & M. J. Markets
Chem. & Met. Eng.	Factory Mgt. & Main.
Coal Age	Food Industries
Construction Methods	Power
Electrical Contracting	Product Engineering
Electrical Merch.	Textile World
Electrical World	Transit Journal

Departmental Staff

**McGraw-Hill Publishing Co.**

330 W. 42nd St., New York City

*In the News*

[FROM PAGE 133]

ous types of steel, iron and non-ferrous metals. One entire section is devoted to a thorough discussion of the structure and properties of weld metal.

Since welding provides greater latitude in structural design a large portion of the handbook is devoted to designing for arc welded construction of machinery and structures. Detailed examples are included. Another section covers typical applications of arc welding in manufacturing, construction and maintenance.

The contents of the Handbook are divided into eight specific sections covering: Welding Methods and Equipment; Technique of Welding; Procedures, Speeds and Costs; Fleet-Fillet Technique; Weld Metal and Methods of Testing; Weldability of Metals; Welded Steel Construction—Machine Design; Designing of Arc Welded Structures; Typical Applications of Arc Welding in Manufacturing Construction and Maintenance, Reference Data on physical constants and properties of metal and other pertinent tables.

Almost 300 contributors from the field of welding have presented the data in this "Bible of the arc welding industry" to give men in shops, industry, shipyards, plane plants, ordnance plants and arsenals, a comprehensive up-to-date treatise in the subject. Procedure Handbook of Arc Welding Design and Practice, seventh edition, 1,308 pages, 6 by 9 inches; 1,810 illustrations. Semi-flexible gold embossed simulated leather cover. Price \$1.50 in U.S.A.; \$2.00, elsewhere. Published by the Lincoln Electric Company, 12818 Coit Road, Cleveland, Ohio.

## Priorities

### PD-200 REVISED FORM AVAILABLE

A revised project application form PD-200, which is to be used for obtaining priority assistance and authority to begin construction for most construction items and equipment, is now available for use.

This form must now be used as an application for: Authority to begin construction pursuant to the provisions of the Stop-Construction Order L-41. Priority assistance for any project involving new construction, reconstruction, remodeling or conversion. Priority assistance for equipment when construction is involved. PD-1A applications formerly submitted for such equipment will no longer be accepted. When no construction is involved, however, PD-1As will continue to be accepted for equipment.

This revised PD-200 does not replace PD-105, used for privately financed war housing, or PD-406, used for remodeling houses in critical defense areas. Neither

does it replace form PD-3A, used for projects owned by the armed services and identified as "command" construction.

Pd-200 applications are available at all WPB field offices, the County War Boards of the Department of Agriculture, field offices of the Federal Housing Authority, field offices of the Army, Navy and Maritime Commission and many financial institutions.

The form is now used in other "command construction". To reduce delays in processing, the PD-200 form has been correlated with the utilities application for utilities work in connection with a construction project.

Machinery and equipment required for a project have been separated from the construction materials and are listed in new sections. The machinery section has been divided among metal working equipment, power equipment and other machinery and equipment. The materials list has been increased.

In cases where structural steel is used a certificate must be attached to PD-200 stating that WPB emergency specifications have been complied with.

## COPPER PROHIBITED IN FUSE PARTS

In order to save 1,200 tons of copper annually, the WPB prohibited the use of the metal or its alloys to manufacture parts for fuses, other than current-carrying parts, effective 15 days from August 25.

The order, Limitation Order L-161, also prohibits the assembly of fuses with copper parts other than parts carrying electric current, effective 30 days from the same date.

Sales of fuses by manufacturers are restricted, effective 15 days from August 25, to sales to other manufacturers, or on A-10 or high preference ratings. Adequate supplies are expected to be made available to civilian users of fuses since distributors are permitted to obtain fuses and other electrical supplies through the use of Form PD-1.



A QUARTER CENTURY ago, 27 years to be exact, Roy Springer took a fling at the electrical business. Today he is president of Ross Electric Co., Superior, Wis., one of the larger electrical contractors of the Twin-Ports area.

# WHERE TO BUY

Equipment, Materials and Supplies for  
Electrical Construction—Maintenance—Repairs

**WILEY**



## FLUORESCENT LIGHTING Instantaneous Starting ELIMINATES STARTER TROUBLE

New WILEY Fluorescent Fixtures can now be supplied with equipment for absolute starting. Lights come on fully at the turn of the switch.

WILEY Industrial Fluorescent Fixtures are made in all types for all applications, close to ceiling or suspended, continuous or separate units, open reflector or louvered. Units are complete requiring no connecting boxes.

Write for Booklet EC-102

**R. & W. WILEY, INC.**

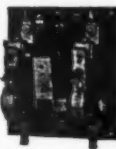
777 Hertel Ave. Buffalo, N. Y.  
Member Fleur-O-Lier Manufacturers Association

## ON THE JOB EVERY INSTANT

### ZENITH

MAGNETIC  
CONTACTOR

Especially developed for severest duty with large electric flashers, and heavy surge of Type C lamps. Electrically held. Hum reduced to minimum. Used with Time switches, flashers, bombardiers, many other purposes. 30 to 400 amps. A.C. & D.C. Get complete Catalog of Zenith Automatic Equipment.



**ZENITH ELECTRIC CO.**

845 S. Wabash Ave., Chicago, Ill.

ALLEN-ALUMI-SODER

### SODER ALUMINUM

Joints "strong as welded"

Sample on Request

**L. B. ALLEN CO., INC.**

6715 Bryn Maur Ave.

Chicago

### Your inquiry

will have special value . . .

if you mention this magazine, when writing advertisers. Naturally, the publisher will appreciate it . . . but, more important, this proof of active reader interest will demonstrate to the advertiser the usefulness of—and demand for—the vital service rendered by his advertising.

## TEST-O-LITE

Tests Everything Electrical  
From 100 to 550 Volts

Indispensable to electricians. Equipped with Neon light which tells instantly where trouble lies in electric circuits, fuses, cut-outs, motors, radios, electric appliances; indicates hot or grounded wires; tells A.C. from D.C.



Only TEST-O-LITE, original Neon tester, has exclusive patented safety features. Far superior to clumsy test bulb. Fountain pen size with pocket clip. Useful in homes also.

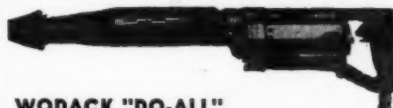
List \$1.50

at leading jobbers.

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Plan and Estimate  
Wiring Installations

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HEAVY WALL CONDUIT FITTINGS  
THIN WALL CONDUIT FITTINGS  
BUSHINGS AND LOCKNUTS  
CONDUIT AND CABLE STRAPS  
R E A FITTINGS  
TOOLS  
LUGS  
NIPPLES  
WIRES AND CABLES  
ARMORED CABLE  
THIN WALL CONDUIT  
HEAVY WALL CONDUIT

These are just some of the items shown in our new 1942 144-page catalog. It is full of useful information and contains hundreds of illustrations that will be most helpful to you. Send for your copy today—ask for Catalog No. CF17.

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**REFLECTORS**  
FOR ALL NEEDS

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SEND FOR CATALOG

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ELECTRICAL MANUFACTURING CO.  
1840 W. 14th St., CHICAGO, ILL.

*In the News*

[FROM PAGE 137]

### FLEXIBLE RATING FOR SERVICES

Installation of utility facilities using critical materials in defense-rated projects will be expedited under terms of an amendment to P-46.

The amendment provides that suppliers of utility services to projects rated A-5 or better which require iron, steel or copper for their construction will be granted the highest rating assigned to other equipment for the project which also uses iron, steel or copper.

All other required utility facilities will be assigned the lowest rating granted to materials for the project, so long as the rating is not below A-5.

The effect of the amendment will be to assure completion of high-rated housing and other defense projects which might otherwise be held up because of inability to obtain materials for different types of utility extensions.

— WITH THE —  
*Manufacturers*

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### The Stone You Can Bend and Twist



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What a job FLEXSTONE does! Cuts like an abrasive stone—but you can bend, twist it. Won't break! Thin, non-brittle. Sharpest abrasives are pressed into flexible core. Easily fits tight places. Smooths hardest contact points in relays, cutouts — cleans small commutators, switches, etc. Non-conductor — no short circuit. Rimac FLEXSTONE speeds electrical service. Send for free sample!

RINCK-McILWAINE, Inc., 16 Hudson St., New York, N. Y.

### G-E Changes

G. R. Bryant, formerly with the Lighting Sales Section of the General Electric Lighting Division at Schenectady, has been named G-E lighting specialist for Western New York State, with headquarters at Buffalo. He succeeds the late J. E. Schell.

Stanley C. Schuler, recently resigned as associate editor of *House Beautiful* magazine, is now with the New York public relations section of G-E. He succeeds Lieut. W. H. Dinsmore, now in active service with the U. S. Navy, as general assistant to K. G. Patrick, who is in charge of the office.

Edward L. Robinson has been appointed New York publicity representative of the G-E radio, television and electronics department.

The Vacuum Tube Division of the G-E Radio, Television and Electronics Department has changed its name to the Electronic Tube Division.

### Graybar Appointments

On September 15 Willard E. Henges became the new District Manager of the St. Louis office of Graybar Electric Company. He replaces George Corrao, who has asked to be relieved of active duty subject to retirement next year.

W. W. Castleberry, formerly Service

Supervisor at Graybar Electric Company's Miami office, was appointed acting service manager at Graybar-Jacksonville. He replaces A. W. Palin, Jr., who has been granted a leave of absence to take up active duty as a Captain in the U. S. Army Air Corps.

General Electric Supply Corporation has moved its Dayton, Ohio, office and warehouse from 601 East Third Street to new headquarters at 712 West Third Street.

Square D Company, Detroit announces the opening of two new branch offices. C. T. Nash, formerly with the company's New York office has charge of the new office at 146 Chestnut Street, Springfield, Mass., and W. W. Hendrickson has been transferred from the Charlotte office to open a new office in Greensboro, N. C., located at 303 Kensington Road.

The Thermador Electrical Manufacturing Company of Los Angeles has announced its purchase of the machinery, dies, equipment and inventory of the Inca Manufacturing Division at Los Angeles of the Phelps Dodge Copper Corporation.

Fostoria Pressed Steel Corp., Fostoria, Ohio, announces the appointment of Willard S. Crandall as Director of Engineering. He succeeds Lieut. Ray N. Green, who entered the service of the armed forces last fall.

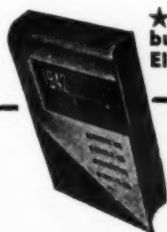
Roller-Smith Company, Bethlehem, Pa. has named William N. Grooms, Salt Lake City, Utah as a district sales agent. Mr. Grooms will maintain offices at 630 Dooly Block, Salt Lake City and will cover the states of Utah, Idaho, Montana and the southwest corner of Wyoming.

Commercial Investment Trust Corporation of New York has purchased the Holtzer-Cabot Electric Company of Boston. Holtzer-Cabot is the first manufacturing subsidiary of C.I.T.

The Artkraft Sign Company of Lima, Ohio has entered into the hot cathode fluorescent lighting field. The company has set up a permanent Lighting Institute and laboratory in a new building recently taken over for the manufacture of lamps and fixtures, so as not to interfere with its production of war materials in its home office plant at Lima.

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★ These companies have included Briefalogs, containing additional buying information on their products, in the 1942 edition of the Electrical Buyers' Reference.





**By Major General  
Lewis B. Hershey, U. S. A.**  
*Director of Selective Service*

**M**ANPOWER is a most important strategic material of today. Every employer should make a prompt inventory, appraisal and analysis of the manpower in his own plant as he would inventory his stock pile. In order to keep production going and at the same time furnish men for the armed forces, industry should now establish replacement program.

In order to secure temporary deferments for essential men while he is training women, young men, older men, men physically handicapped or those with a high degree of dependency, the employer should know the fundamental principles in the operation of his local Selective Service Board. Certain steps should now be taken by each employer. He should know how many men on his payroll are between the ages of 20 and 45. He should investigate the classification of every one of those men. On the basis of such an inventory he should prepare to plan ahead and train men for replacement of those who must necessarily enter the armed forces if we are to have the sort of army which can win the war.

Deferments, granted so that employers may train women or men not liable to early induction, are temporary deferments; they cannot exceed six months and in many cases may be for only thirty, sixty or ninety days. The Army today has to train a bomber pilot within a period of eight months to operate a very technical machine with an instrument board which puzzles an expert. Why, therefore, should industry insist that it assume that it can take two or

three years to train men for industrial tasks not nearly so complicated?

The fundamental purpose of every deferment of a registrant is to allow an employer to train a replacement. Only in a few rare instances can an employer expect to have these temporary deferments continued for more than the six months period. These are only in cases where an abnormally long period of training is required for a replacement and the eight months needed in which a bomber pilot can be turned out now, is something to remember.

Employers may seek the deferment of their necessary men with or without their consent.

Here is how they go about it.

On page three of the Selective Service Questionnaire (Form 40) which is sent to each registrant before he is classified is the following:

*Instructions.—If your employer believes that you are a necessary man in a necessary occupation, it is his duty to fill out Form 42A requesting your deferment. You may also attach to this page any further statement by yourself which you think the local board should consider in determining your classification. Such statement will then become a part of the questionnaire.*

This is on all the questionnaires distributed during the past six months. The fact that the Selective Service System now specifically mentions the filing of Form 42A as the manufacturers' duty is a clear indication of the Selective Service System view on the responsibility of each employer.

The employer can secure Form 42A at the local board and the local board will consider the employer's request when the form is properly filled out.

If such request should be denied because the man, after consideration of the claims offered for him, is not considered to be indispensable to the company's operation, and is needed more in the armed services, the local board will advise the employer of its refusal of such an occupational deferment.

The local board does this by sending to the employer, at the same time it notifies the registrant of his classification, a Form 59.

There are ten days after Form 59 is

mailed by the local board to the employer during which the employer can appeal the registrant's case.

In order to take an appeal the employer simply has to sign his name to Form 59 which he has received, and return it to the local board; or in case the Form 59 is not received from the local board, any written request will have full value to make such an appeal effective.

When Form 59 is returned by the employer the appeal procedure becomes automatic.

All necessary forms are available at the local board in the employer's immediate vicinity or at the office of the State Director of Selective Service.

If the local board and the appeal board deny the appeal for the occupational deferment of a key man, the employer may then bring the matter to the attention of the State Director at the State Selective Service Headquarters, with the request that the case be reopened or appealed by him to the President.

A double duty rests upon the employer. He should personally know what his manpower situation is. He should not leave the job to a minor employee to decide who is necessary. The employer engaged in essential war production who has been required to greatly expand his plant and who then fails to request deferment for his key men is also negligent.

Make an inventory, request deferment for any man whose immediate going into the armed services would retard production of vital war material or other services essential to the war effort, or who is needed to maintain national health, safety and interest.

Only when an employee is working in a critical occupation within an essential industry should a Form 42A be filed for his temporary occupational deferment.

When we hear of the big armies we are going to raise, we must all remember that it takes at least five men or women to produce what they eat, use, fight with, and wear. With less than sixty million available in this country, those figures are worth deep consideration.



# Complete Accessibility

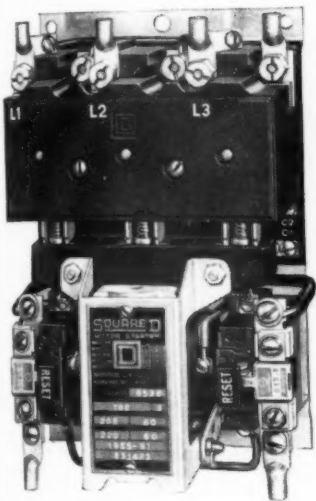
## means faster, easier servicing of motor starters

*All renewable parts of Square D AC electric motor starters can be inspected or replaced in a matter of seconds—using only a screwdriver*

Top operating efficiency and long life of electric motor starting equipment depend largely on regular inspection and occasional servicing.

Today—with every minute at a premium—this inspection and servicing job is more important than ever to avoid time-wasting breakdowns.

Square D Class 8536 AC magnetic starters, with their simple compact construction and vertical action, are completely accessible. An electrician, without special tools, can exchange magnet coils, contacts or overload relay units—in practically no time at all.



1 Both stationary and movable contacts are exposed for inspection by merely loosening two screws and removing the arc chamber cover.

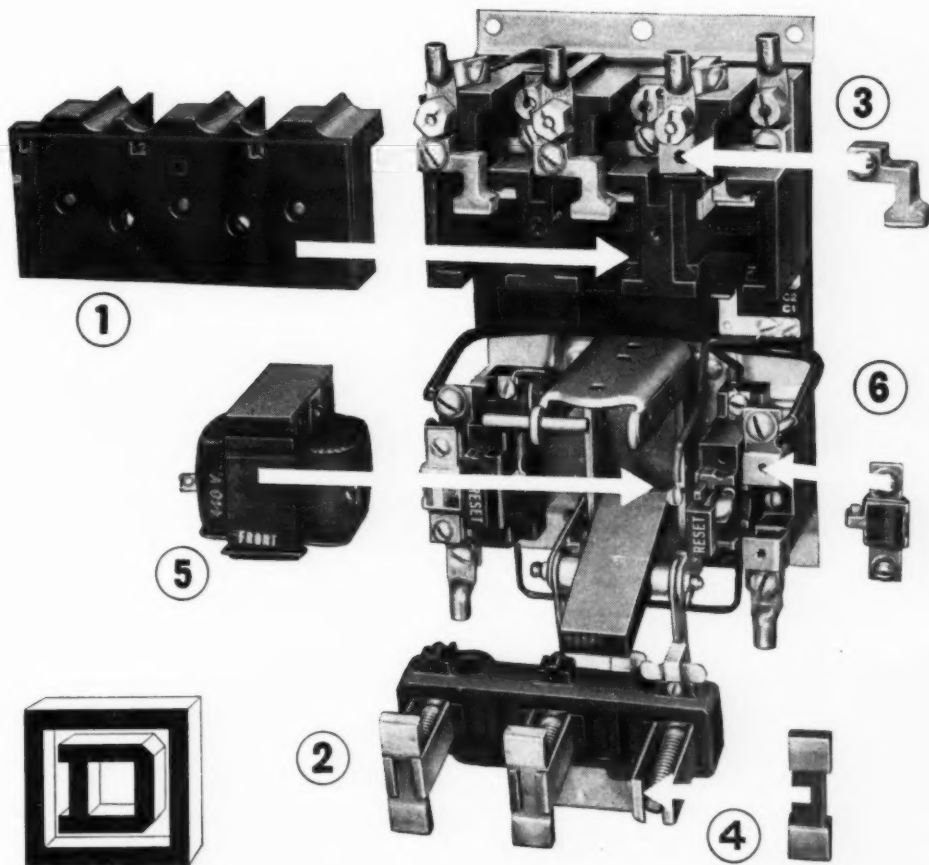
2 With cover removed, movable contact yoke bar can be swung forward to uncover operating magnet and coil.

3 Each stationary contact is held in place by a single screw. Removal does not disturb line or load connections.

4 Movable contacts can be turned 90° and removed from retaining clips without tools. Movable as well as stationary contact tips are silver—require no cleaning or dressing.

5 With coil connections removed, magnet frame and coil are lifted out by sliding locking clips and retaining pin out of position.

6 Clearly marked melting alloy type thermal overload relay units—interchangeable to suit motor characteristics—are easily attached at either side of the starter. Heater, melting pot, and ratchet wheel comprise an integral unit. Repeated tripping causes no deterioration and no parts need to be renewed following overload.



WRITE FOR BULLETIN 8536

**SQUARE D COMPANY**

DETROIT - MILWAUKEE - LOS ANGELES

KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO



C. E. McClintock (left), salesman, General Electric Supply Corporation, Akron, Ohio, and C. K. Henry, C. K. Henry Electric Co., Akron, are here discussing the new Moncor Surface Wiring Devices. Mr. McClintock is pointing to the knockout feature in the end of the devices.

# North-South-East-West

## G-E

### WIRING MATERIALS DISTRIBUTORS

**Are Eager to Help You with War Projects**

Rush war order is here being filled at the Central Queens Electric & Lighting Fixture Corp., Jamaica, N. Y., G-E distributor. Men in picture left to right: Jack Twersky, purchasing agent; A. Blumenstetter, electrical contractor; L. Weinberg, stock clerk; Andy Mosca, Central Queens salesman; and Larry Berken, president, Central Queens.



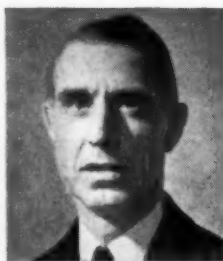
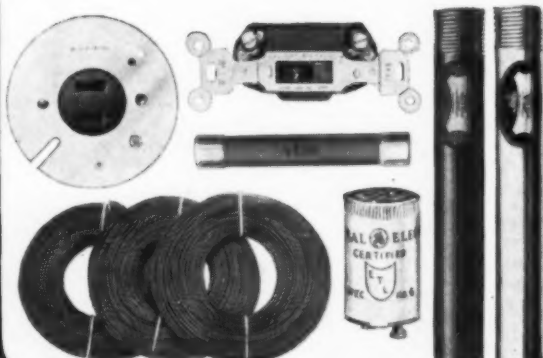
G-E Wiring Materials Distributors are located at key points all over the country. One is near you. This means that wiring materials for war projects can be obtained without delay. These distributors want to co-operate with you in aiding the war effort every way they can.

All the wiring materials you need for any war job are handled by G-E Wiring Materials Distributors—conduits, boxes and fittings, wires and cables and wiring devices. Materials for standard wiring and for special wiring are included. They are all high quality, easy to use and dependable.

Ask a representative of the G-E Wiring Materials Distributor near you to call. Put your wiring problems up to him. You'll find his suggestions helpful. They'll be based on long experience and a knowledge of proven wiring practices. He'll help you select wiring materials for war jobs and will follow delivery schedules personally.

#### FOR G-E WIRING MATERIALS

Ask your G-E Wiring Materials Distributor about G-E conduit, boxes and fittings, wire and cable and wiring devices to fit your needs. General Electric Company, Appliance and Merchandise Department, Bridgeport, Conn.



Ralph W. Hunting, manager, General Electric Supply Corporation, Sacramento, Calif., is shown in the warehouse checking a rush order of wiring materials to be sent to U.S. Army engineers.

In all parts of the country a field force of G-E district representatives helps distributors serve customers. Here is L. D. VanDerBeek, who covers the borough of Manhattan in New York City.



**GENERAL  ELECTRIC**

